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INVESTIGATION OF THE EFFECT OF
STIFFNESS OF MEMBERS UPON
THE SOLUTION OF VIERENDEEL TRUSSES

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Thesis
M3

Postgraduate School.
U. S. Naval Academy,
Annapolis, Md.

INVESTIGATION
OF
THE EFFECT OF STIFFNESSES OF MEMBERS
UPON THE SOLUTION OF VIERENDEEL TRUSSES

by

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Submitted to the Faculty of Rensselaer Polytechnic Institute in Partial Fulfillment of the Requirements for the Degree of Master of Civil Engineering.

Troy, New York

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TABLE OF CONTENTS

Acknowledgment	i
Introduction	ii
Method of Solution	iii
Purpose	ix
First Solution Resume	xii
Second Solution Resume	xiii
Third Solution Resume	xiv
Fourth Solution Resume	xv
Design Moments	xvi
Results	xvii
Conclusions	xxvi
Computations	
First Solution	1
Second Solution	57
Third Solution	103
Fourth Solution	143
Drawings	see appendix
Elevation of Truss	
Influence Lines for Computations	

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Introduction

A Vierendeel Truss is composed of a series of rectangular or trapezoidal panels without diagonal members. It is named for its inventor, Professor Arthur Vierendeel of the University of Louvain in Belgium. This type of truss has been popular in Europe, particularly in Belgium, since 1896 when the first bridge of this type was built in that country. In the United States its use to date has been limited to concrete viaduct bents, small roof trusses, and rigid frame foundations for buildings. It has been reported that a bridge using a concrete Vierendeel Truss system has been built recently on the West Coast, but as yet there is no printed matter available on that project.

The Vierendeel presents an exceptionally good appearance, the elimination of diagonals allowing a very clean looking structure. Its slow adaption in this country may be attributed to two factors; (1) until recently the only methods of solution were extremely long and tedious, sufficiently so to discourage only the most able and experienced in the field of structural design, and (2) the use of this truss has been so limited in this country that very few examples are available from which to make an intelligent investigation of the economic aspects of the problem.

METHOD OF SOLUTION

The method of solution used throughout this thesis was an application of slope deflection as outlined by Mr. A. Amirikian in his "Analysis of Rigid Frames". While there are other methods available for the solution of Vierendeel trusses it was felt that the procedure outlined by Mr. Amirikian was the simplest and most direct approach to the problem published to date. Inasmuch as his text has become a standard addition to all libraries of treatises on Indeterminate Structures, none of the derivations will be presented here and only a brief outline of the basic formulae and procedures will be given.

By way of simplifying the fundamental moment equation of a member having constant moment of inertia and modulus of elasticity

$$M_{AB} = 2 E \frac{I}{L} (2\theta_A + \theta_B - 3 \frac{\Delta}{L}) - FM_{AB}$$

the following abbreviated form is used

$$M_{AB} = K (A + \frac{B}{2} - R) - FM_{AB}$$

where

$$K = \frac{I}{L}$$

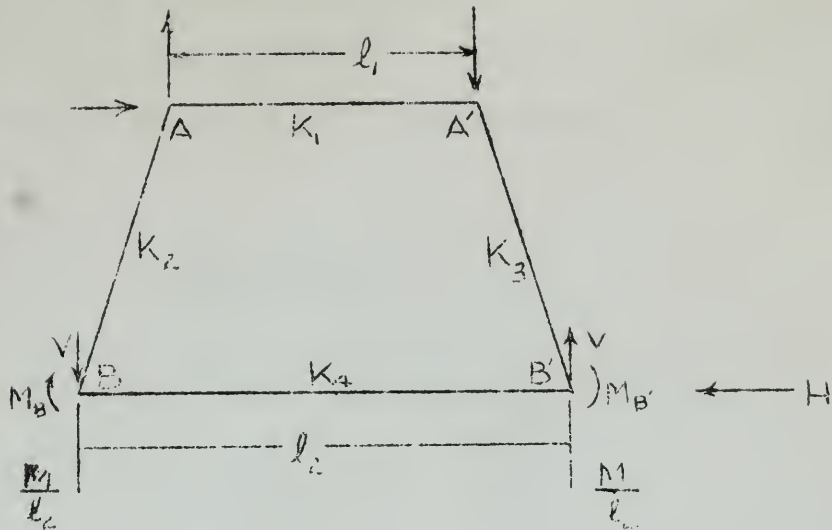
$$B = 4E\theta_B$$

$$A = 4 E\theta_A$$

$$R = 6E \frac{\Delta}{L}$$

This simplification is used throughout the solution and greatly reduces the tediousness of the more complex equations.

Upon connecting four of these beams to form a panel and a series of panels to form a truss, the interdependence of the members and joints becomes pronounced. In order to consider the effect of varying stiffnesses in members forming or adjacent to a joint on both the moment at the joint and the deflection in the beam, expressions are developed for each joint encountered. These expressions will be known hereafter as the Joint and Deflection Equations. Likewise the moments obtained in the solution of any joint will vary widely with the shape of the panel, moments and shears applied and location of application, and the stiffnesses of the panel under consideration. In order to take these variables into consideration, Load Constant Equations are derived for each joint. Upon solution of these equations the load constant is equated to the Joint and Deflection equations which are then solved to find the deflection angles of the joints and the deflection of the adjacent member. Because of its basic nature the fundamental expression for the load constants of a typical panel are reproduced here in part.



$$(a) \quad M_B + M_{B'} = V l_2 - H$$

$$(b) \quad M_A + M_{A'} + M_B + M_{B'} = V(l_2 - l_1) - Hh$$

Substituting V from (a) in (b)

$$(c) \quad M_A + M_{A'} + (1-m)(M_B + M_{B'}) = mH - Hh$$

where

M = overturning moment of the external forces taken about the bottom of the panel.

H = shear, i.e., the sum of the lateral forces above the panel.

V = vertical reaction just above the bottom joints of the panel.

M_A = end moments at top.

M_B = end moments at bottom.

K = values of load constant for joint or panel under consideration.

$$m = \frac{l_2 - l_1}{l_2}$$

$$n = \frac{l_1 - l_2}{l_1}$$

By substituting the right hand part of equation (c) in a previously developed shear expression for a typical joint equation we arrive at load constants for a typical panel

$$Q \text{ of } R = \frac{Hh - mM}{(2-m)(k_2 - k_3)}$$

$$Q \text{ of } A = \frac{(nk_1 - k_2)(Hh - mM)}{(2-m)(k_2 - k_3)}$$

$$Q \text{ of } B = \frac{k_2 (mM - Ph)}{(2-m)(k_2 - k_3)}$$

Further importance is attached to equation (c) inasmuch as it acts as a check for the moment values obtained in the solution of any panel.

The procedure for the solution of Vierendeel trusses is an adaptation of this single panel solution. In order to avoid the difficulty of an exact solution the truss is first treated as a system of separate and independent panels. Each panel is solved for its own load neglecting moment introduced from other panels via the joints. To compensate for the error introduced in the original computation the solution is repeated, this time using the moments obtained from adjacent panels as the new load constants for the panel being solved. The procedure is repeated, again interchanging moment increments between panels. Inasmuch as these increments diminish in size rapidly, two corrections will ordinarily provide a solution of sufficient accuracy.

The final moment will be the algebraic sum of the original moment determination and the successive increments.

For the Vierendeel truss used in this design with all loads applied at the panel points and the upper and lower chords having the same stiffness ratio, the deflection angles of the top chord joints will equal those of the respective bottom chord joints, and the joint and deflection equations become:

$$1.5K_1 + K_2 + \frac{(3 - m)(nk_1 - k_2)}{2(2 - m)} A =$$

$$\frac{k_2}{2} + \frac{(3 - 2m)(nk_1 - k_2)}{2(2 - m)} B = -Q_A$$

$$k_2 + 1.5K_4 + \frac{(3 - 2m)k_2}{2(2 - m)} B =$$

$$\frac{k_2}{2} + \frac{(3 - m)k_2}{2(2 - m)} A = -Q_B$$

$$R_1 = \frac{(3 - m)A + (3 - 2m)B}{2(2 - m)} = Q_{R1}$$

These equations, with appropriate K and angle notation are set up for each of the eight panels and equated to the corresponding load constants as obtained from the following formulae:

$$-Q_A = \frac{(nk_1 - k_2)(m\bar{l}_1 - H_1l_1)}{2(2 - m)k_2}$$

$$-Q_B = \frac{(H_1l_1 - m\bar{l}_1)}{2(2 - m)}$$

$$Q_{R1} = \frac{H_1l_1 - m\bar{l}_1}{2(2 - m)k_2}$$

The two equations in A and B obtained from the solutions of these sets of equations are then solved simultaneously and the value for R_1 determined. Substituting in the fundamental moment formulae

$$M_{LB} = K \left(A + \frac{B}{2} - R_1 \right)$$

$$M_{BA} = K \left(B + \frac{A}{2} - R_1 \right)$$

the original moment values for the panel are obtained. These moments are then corrected and the sum of the original moment plus corrections give us the final moment values.

Influence lines were plotted for the final moment values and design moments based on the combined loadings of one E-60 railroad rail and one lane of H15 - S12 - 44 highway loading were computed.

PURPOSE

The purpose of this investigation is to determine the influence of the assumed stiffnesses of the members upon the eventual design of the truss.

In the design of a Vierendeel truss by the method previously described, the first step is to assume a basic truss and loading system. A solution is then worked for this primary system, corrected for the actual loads and conditions, and the solution repeated with appropriate corrections to arrive at the final design, usually three or more solutions being required.

Upon embarking upon this type of solution, the engineer is faced with two fundamental assumptions, (a) the loading to be used, and (b) the stiffnesses to select for his members. The first of these may be handled in the conventional manner, i.e. assume a loading of one kip and compute values for plotting influence lines to which he may later apply his design loads.

The second assumption, selecting appropriate stiffnesses for his members, presents a more difficult problem. Unfortunately so little material has been published on Vierendeel trusses in this country that there is little to guide him in this step.

Likewise the rarity of this type of structure in the United States makes it extremely unlikely that he could obtain any useful data on existing trusses of this type. Obviously it is up to the engineer to make such assumptions as he sees fit. In order to do this properly he should, of course, have some advanced knowledge of the distribution of moments throughout the truss in order that he could correctly proportion his stiffnesses to their appropriate moments. Previous experience lacking, he will be forced to estimate the probable moment intensities and select stiffnesses accordingly. This procedure leaves much to be desired, for regardless of a man's previous experience it is not to be expected that he could closely approximate the distribution of moments in a truss entirely unfamiliar to him, and his stiffness values will be subject to the same degree of uncertainty.

The question now arises as to the degree in which the assumed values of stiffnesses will affect the solution of the truss. It will be noted that the stiffness factor K occurs in four of the six basic equations for the solution, and it might be supposed that any wide variation in the true and assumed values of K would produce a similar

variation in the moment values obtained. It is the purpose of this thesis to determine the effect of widely varying stiffness values upon moments in a typical Vierendeel truss. The case selected was for a 240 foot lift span for a lift bridge across the entrance to a harbor inlet. The span is to carry one lane of highway traffic on each side of a single track standard gauge railway.

FIRST SOLUTION

For the first solution K values were chosen primarily from sample problems accompanying an article on Vierendeel trusses by Mr. Dan Young in the 1937 Proceedings of the A. S. C. E. Whether or not Mr. Young intended that the stiffness values in his problem should closely approximate actual conditions is unknown. On the condition that these values might approximate the trend of moment distribution, our assumed values were made to follow a similar pattern of variation.

SECOND SOLUTION

For the second solution the values of \underline{K} were arrived at by using the moments obtained in the first solution. Since

$$K = \frac{I}{L} = \frac{Mc}{fL}$$

it was possible to solve directly for a value of \underline{K} , inasmuch as members of constant depth (30") were proposed to improve the appearance of the truss and f and L were known values. In this way it was possible to determine the effect of closely approximating moment and stiffness values throughout the truss.

THIRD SOLUTION

For the third solution all K values were assumed to be unity. It was felt that since both moment and stiffness values vary throughout the truss that by holding one of these constant it might be possible to observe the variation of the other. In this way the stiffness values of the second set of computations of any truss might be made to closely approximate the stiffnesses required by the actual moments and thus expedite and simplify the final design of the truss.

FOURTH SOLUTION

For purposes of contrast the stiffness values of the fourth solution were taken exactly opposite to those of the first solution. In other words the same numerical values were used but varying in an inverse order of the first solution. In this way it was hoped to observe the effect of the direction of variations of stiffness values upon the moments computed.

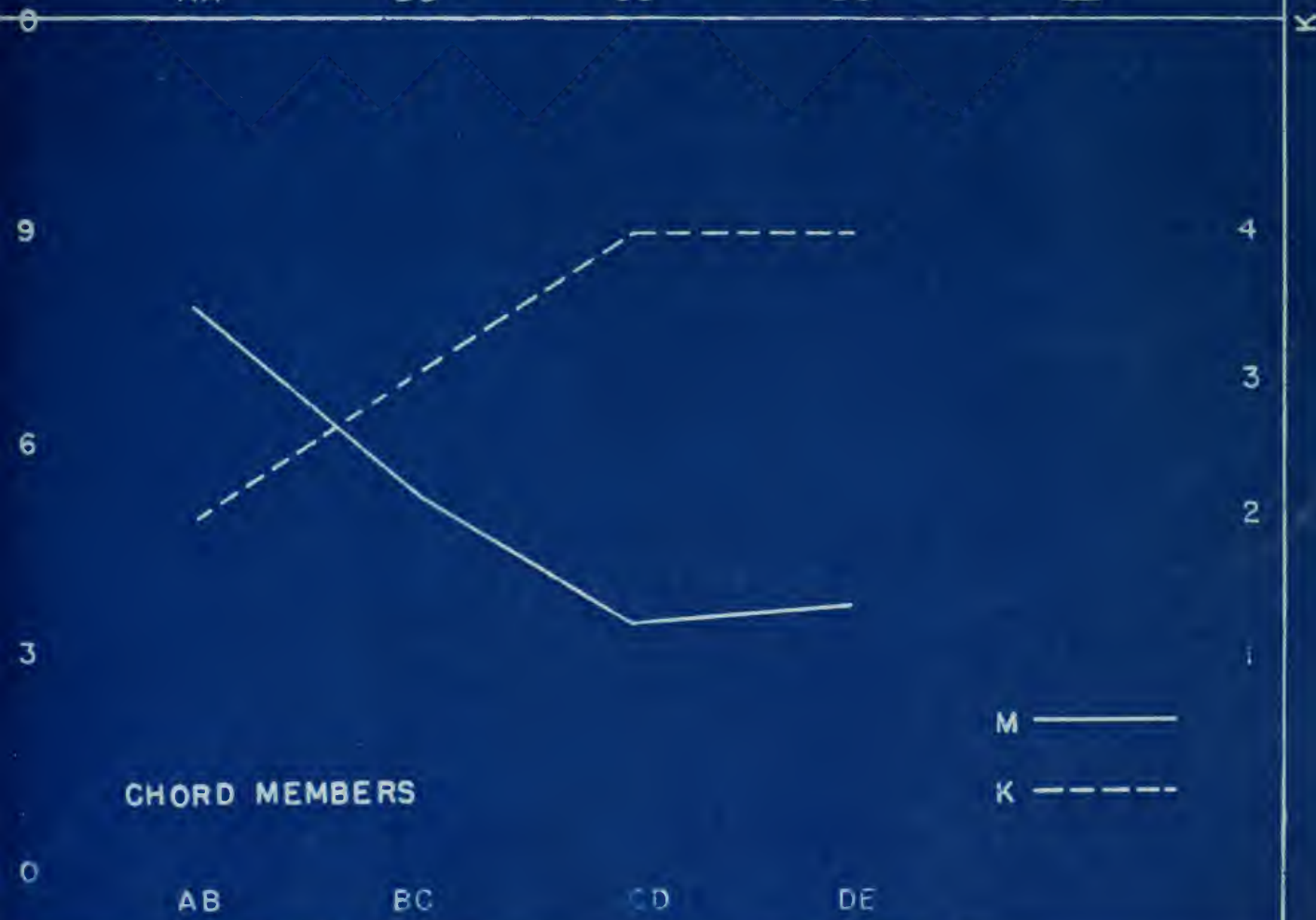
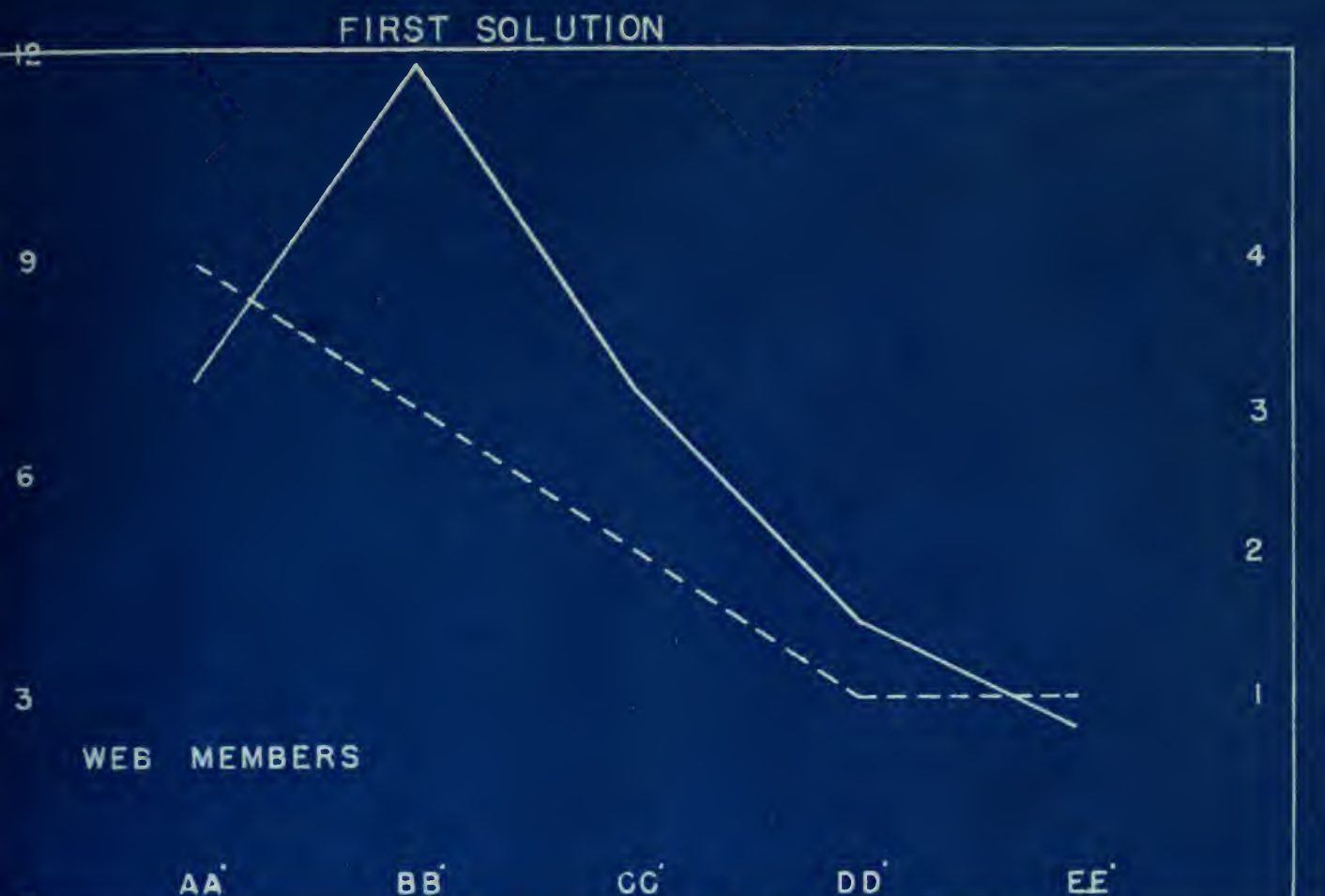
DESIGN MOMENTS

Member	Set 1		Set 2		Set 3		Set 4	
	K	M	K	M	K	M	K	M
AA'	4	7,362	160	7,222	1	7,689	1	7,987
BB'	3	11,745	232	11,762	1	10,600	1	9,030
CC'	2	7,243	136	7,575	1	7,781	2	8,497
DD'	1	4,046	74	4,447	1	5,170	3	5,844
EE'	1	2,593	47	3,000	1	3,282	4	3,435
AB	2	7,958	200	7,212	1	7,689	4	7,987
BC	3	5,360	134	5,492	1	5,465	4	7,329
CD	4	3,548	90	3,529	1	4,043	3	4,436
DE	4	3,790	95	2,877	1	3,020	2	2,986

For purposes of clarity the tabulated results of the moment solutions have been put in graph form on the following pages. Taking web and chord members separately the values of moment and stiffness were plotted for each member for a given solution. The plotted points were then connected in order to indicate the trends of variation of both moment and stiffness. With one exception the moments and stiffnesses as plotted represent the actual values obtained and used in the solution. The one exception is in the case of the second solution. Here the values of K ranged from 200 to 47 and would have been at best unwieldy to plot on the scale adopted. Inasmuch as the numerical value of K appears to affect the solution only in its relative size compared to the other K values the K's for this solution were plotted on a relative scale. By taking $K = 47$ as unity the other K values were reduced to the same relative scale by dividing by 47, greatly simplifying plotting operations and presenting a better method of comparison with the other solutions.

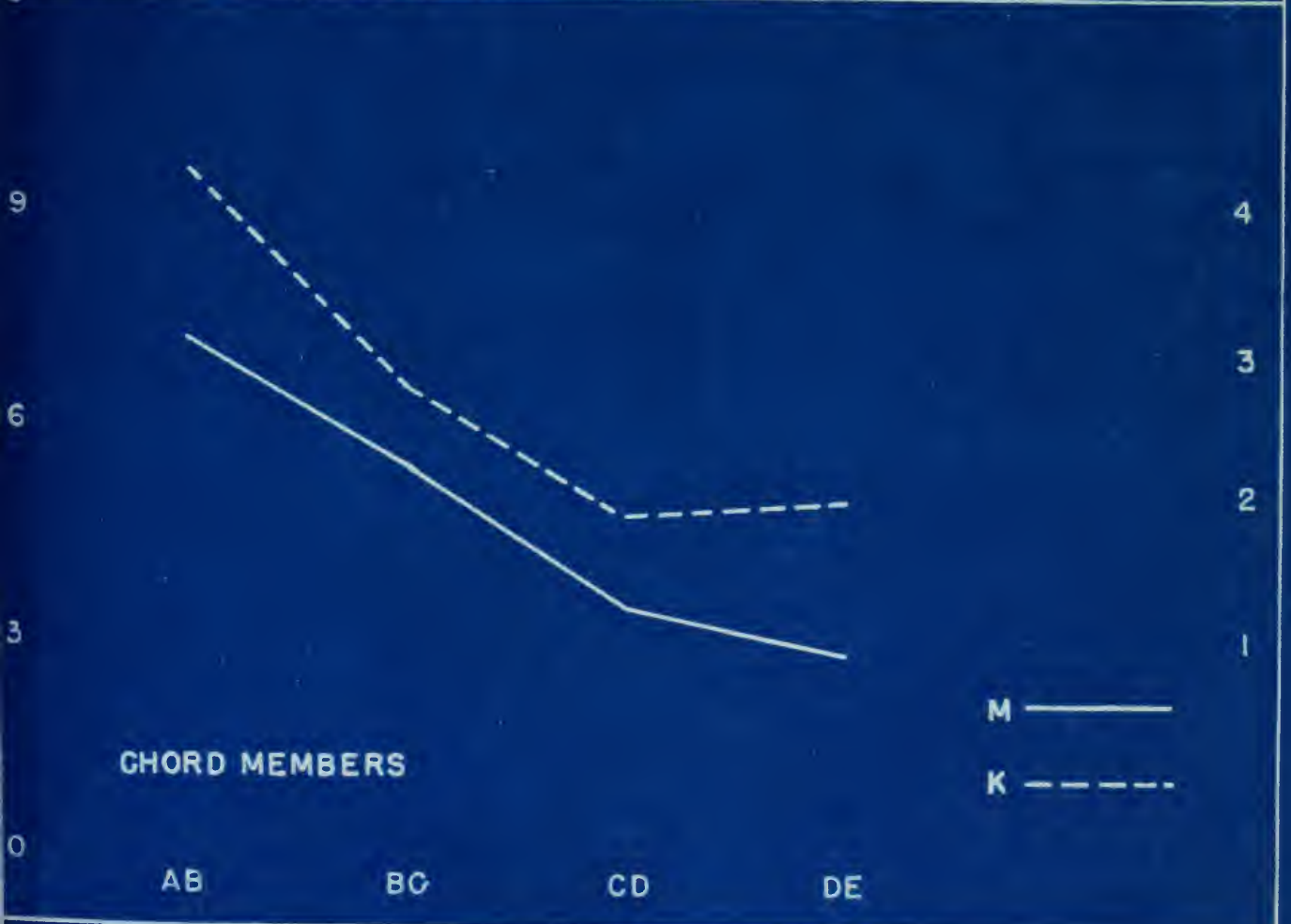
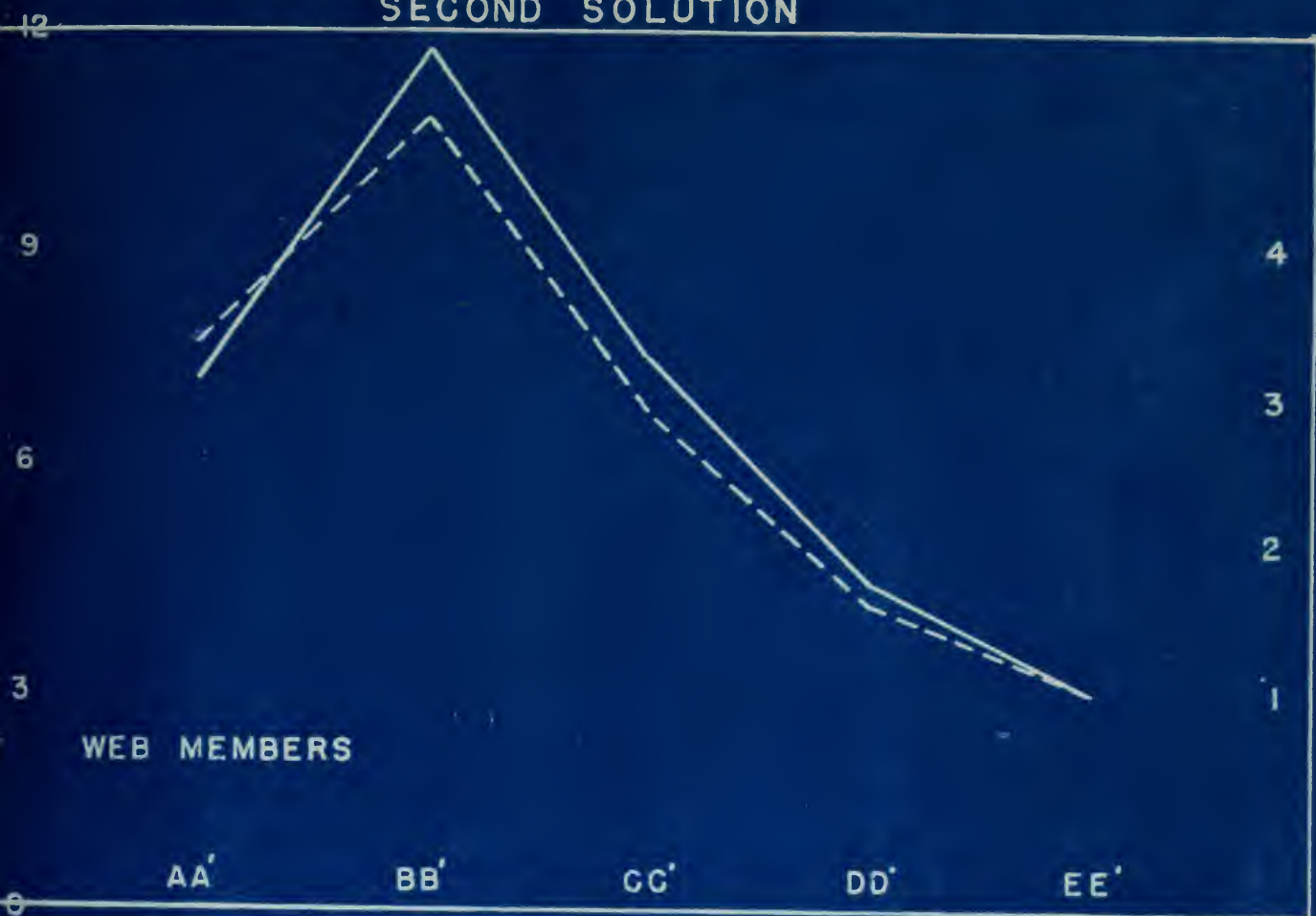
In examining the first solution curves there is little evidence to indicate any direct relationship in the variation of the K values assumed and

the moments obtained. In the case of the web members, CC' and DD' have similar relationships of moment and stiffness. There is an inverse relationship occurring in the case of the other three members. As for the chord members, the inverse relationship exists throughout, high moment values accompanying low stiffness values and vice versa.



The second solution represents a case in which the general trend of moment values closely follows the trend of the stiffness values assumed, with the sole exception of member DE. It is to be noted that there is no proportionality or direct relationship between the values of K and M . While the picture thus presented might seem to indicate a general tendency for moment values to follow stiffness assumptions, it must be remembered that the stiffness values for this solution were obtained directly from the moment values of the previous solution. In effect the moment values have changed but little and by the nature of their assumption it is to be expected that the stiffness values would vary in much the same way as the moment values.

SECOND SOLUTION



The third solution is unique in that it presents an unvarying stiffness curve, all values of K being unity. It is to be noticed that in neither size nor pattern of variation do the moment values differ substantially from the previous solutions. At no place do either of the moment curves display any tendency to follow or parallel the trend of the K values assumed.

1871

1872

1873

1874

1875

1876

1877

1878

1879

1880

1881

1882

1883

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1885

1886

1887

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1890

1891

1892

1893

1894

1895

1896

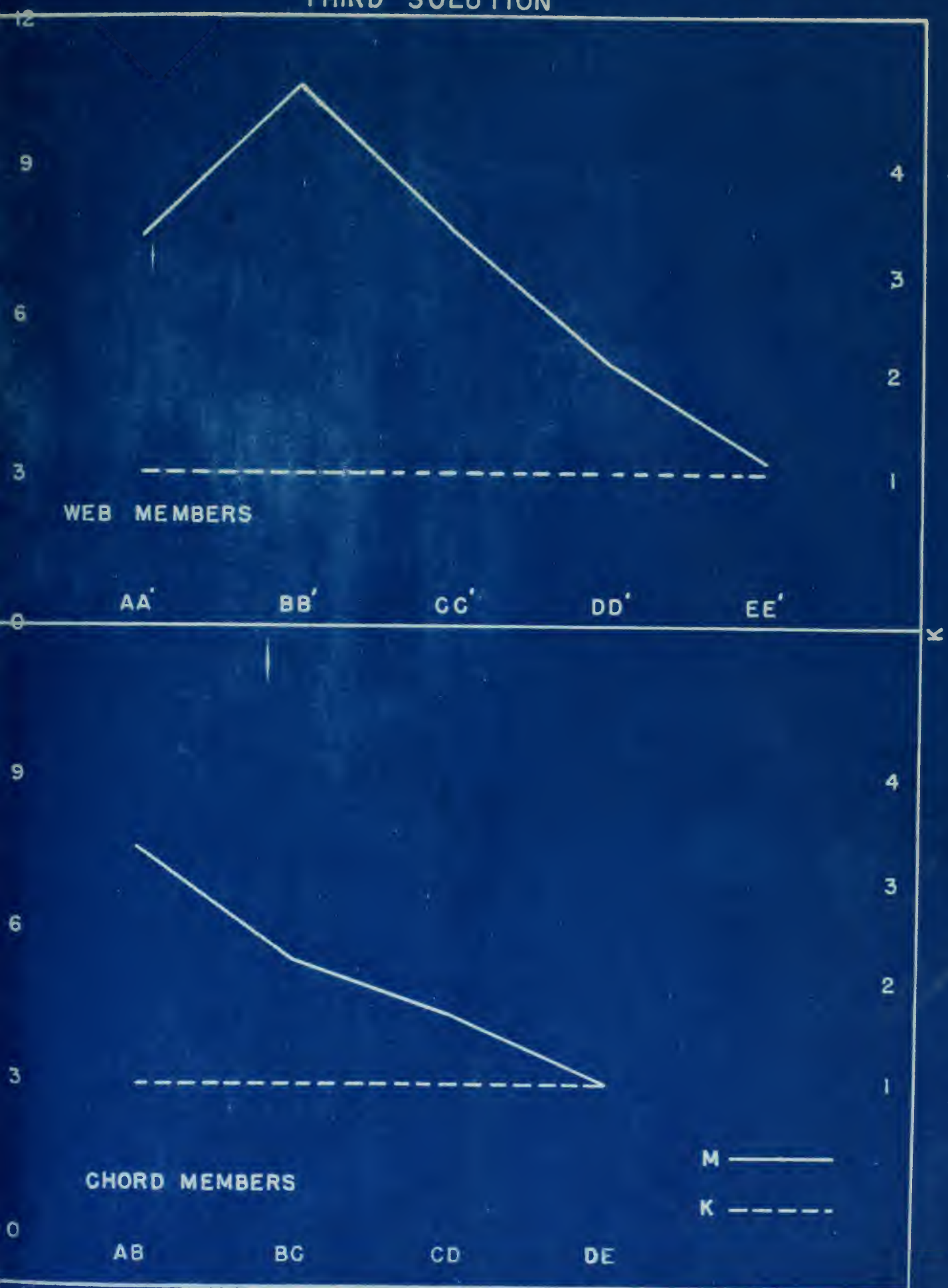
1897

1898

1899

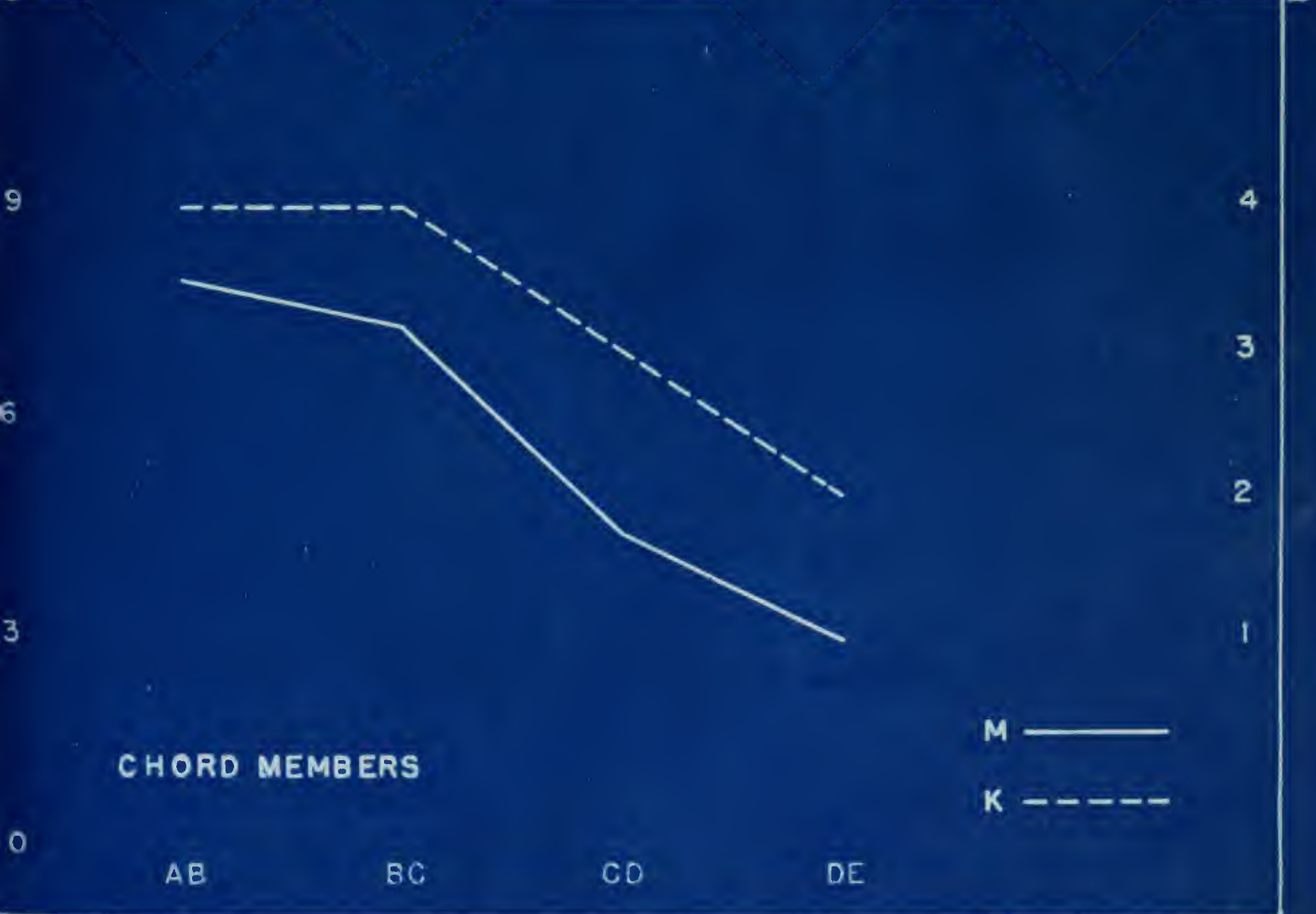
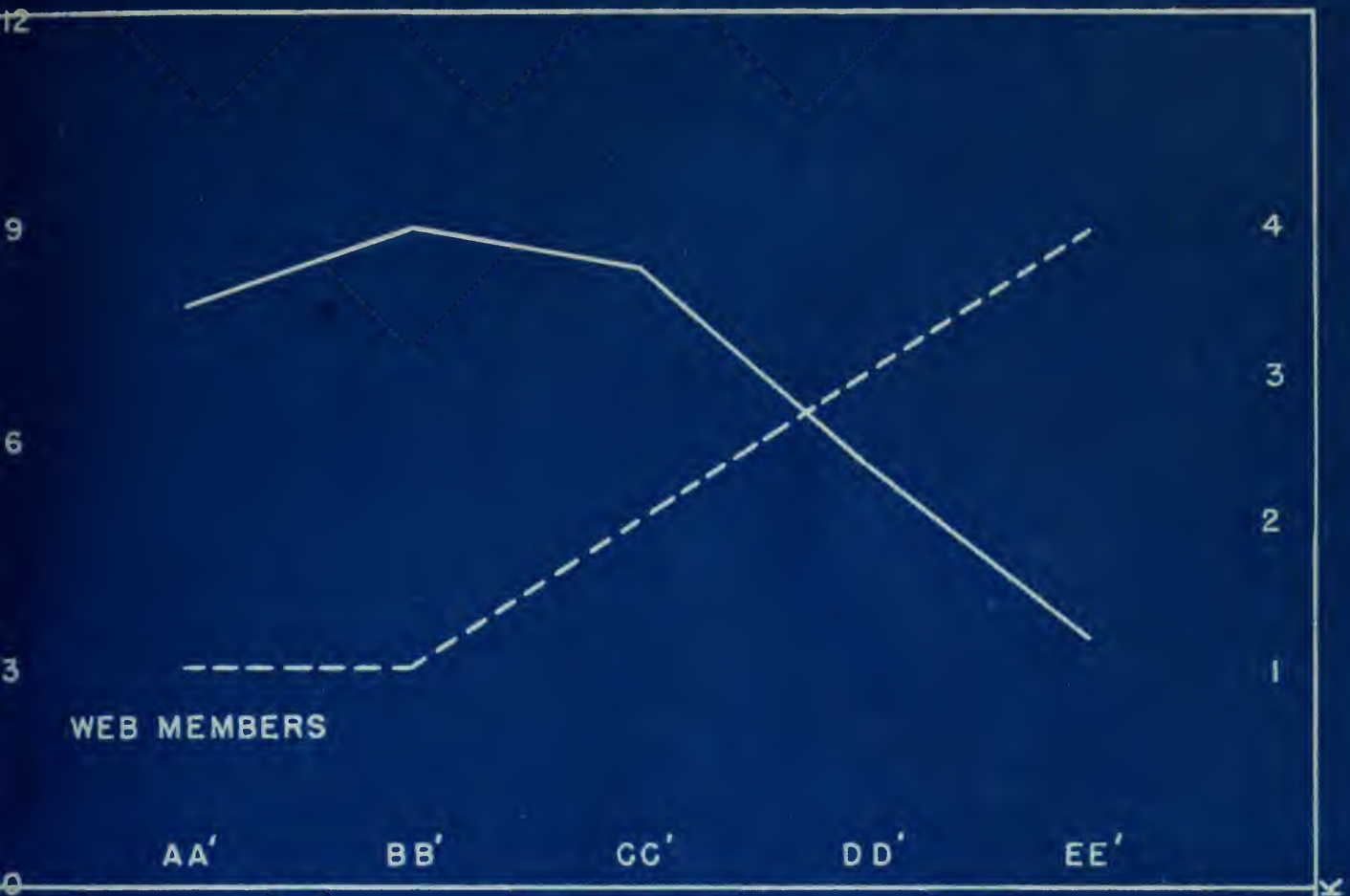
1900

THIRD SOLUTION



The fourth solution graph represents a system of stiffness values assumed in an exactly inverse order of those chosen for the first solution. Contrary to the results obtained in that solution we now find that the chord moments tend to follow the same general pattern as their corresponding K values while the web members follow a completely dissimilar path from their K values. As before there is but little variation in either the size or trend of the moments obtained as compared with the resultant moments of the first solution.

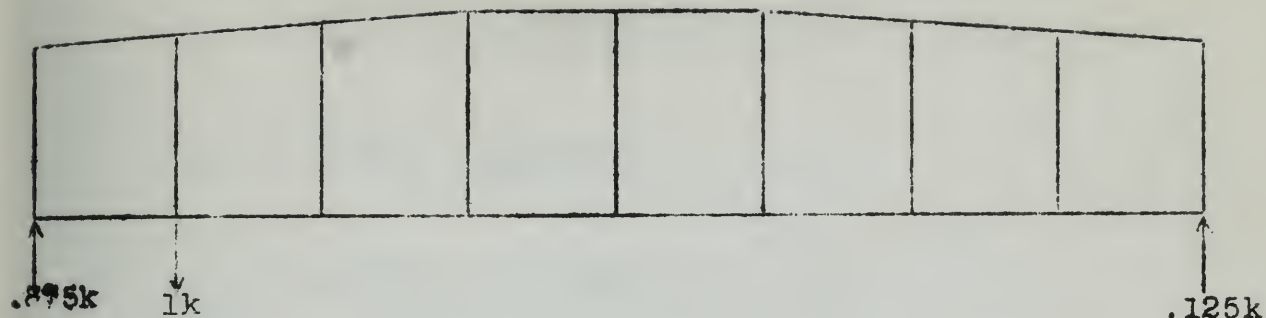
FOURTH SOLUTION



CONCLUSIONS

The results obtained from the four solutions presented show but one common trend, i.e. in no case do the resultant moments of any solution differ widely from those of any other solution. Conversely the stiffness values assumed for any one solution differ widely from those of all other solutions. No relating tendencies are disclosed, a lower stiffness value does not in every case bring a lower moment nor does a higher stiffness value display any significant effect on moments obtained. Likewise a change in the direction of variation of stiffness values seems to have little effect on the moments obtained. Therefore it must be concluded that the size, direction, or degree of variation of assumed values of stiffness of members does not materially affect the moments obtained in the first solution of a Vierendeel truss by this method.

In view of these conclusions it is recommended that in the solution of trusses by this method the first solution be worked with the assumption of all K values as unity. Such an assumption would permit a simpler and quicker solution of the truss with no loss of accuracy.



.0866	.0443	.0482	0	0	.0482	.0443	.0866
.0942	.0463	.0507	0	0	.0507	.0463	.0942
.875	-.125	-.125	-.125	-.125	-.125	-.125	-.125
26.25	22.50	18.75	15.00	-15.00	-11.25	-7.50	-3.75

Panel 1

$$-Q_A = \frac{(.0942 \times 4 - 2)(.0866 \times 26.25 - .875 \times 30)}{2(2 - .0866)2} = 5.32$$

$$-Q_B = \frac{(.875 \times 30 - .0866 \times 26.25)}{2(2 - .0866)} = 6.27$$

$$Q_{R1} = \frac{(.875 \times 30 - .0866 \times 26.25)}{2(2 - .0866)2} = 3.14$$

Panel 2

$$-Q_B = \frac{(.0463 \times 3 - 3)(.0443 \times 22.5 - .125 \times 30)}{2(2 - .0443)3} = -1.16$$

$$-Q_C = \frac{(-.125 \times 30 - .0443 \times 22.5)}{2(2 - .0443)} = -1.21$$

$$Q_{R2} = \frac{(-.125 \times 30 - .0443 \times 22.5)}{2(2 - .0443)3} = -0.40$$

Panel 3

$$-Q_C = \frac{(.0507 \times 2 - 4)(.0482 \times 18.75 + .125 \times 30)}{2(2 - .0482)^4} = -1.16$$

$$-Q_D = \frac{(-.125 \times 30 - .0482 \times 18.75)}{2(2 - .0482)} = -1.19$$

$$Q_{R3} = \frac{(-.125 \times 30 - .0482 \times 18.75)}{2(2 - n)^4} = -.30$$

Panel 4

$$-Q_D = \frac{(0 - 4)(0 + .125 \times 30)}{2(2)^4} = -.94$$

$$-Q_E = \frac{(-.125 \times 30 - 0)}{2 \times 2} = -.94$$

$$Q_{R4} = \frac{-.125 \times 30 - 0}{2(2)^4} = -.23$$

Panel 5

$$-Q_E = \frac{-.125 \times 30}{4} = -.94$$

$$-Q_F = \frac{-.125 \times 30}{4} = -.94$$

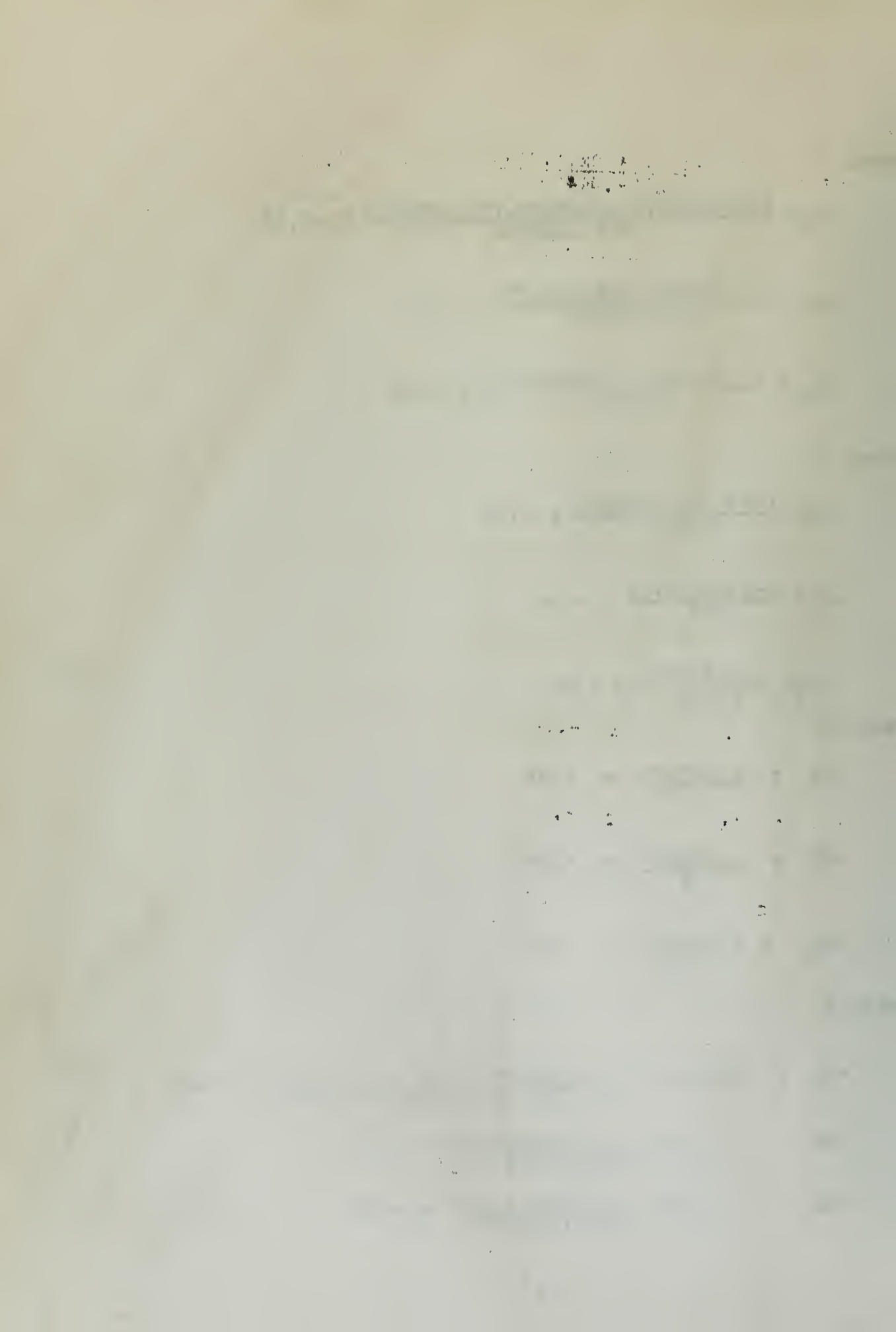
$$-Q_{R5} = \frac{-.125 \times 30}{4 \times 4} = -.23$$

Panel 6

$$-Q_G = \frac{(.0517 \times 2 - 4) - (.0482 \times 11.25 + .125 \times 30)}{2(2 - .0482)^4} = -.80$$

$$-Q_F = \frac{(-.125 \times 30 + .0482 \times 11.25)}{2(2 - .0482)} = -.62$$

$$-Q_{R6} = \frac{(-.125 \times 30 + .0482 \times 11.25)}{2(2 - .0482)^4} = -.20$$



Panel 7

$$-Q_H = \frac{(.0463 \times 3 - 3)(.0443 \times -7.5 - -.125 \times 30)}{2(2 -.0443)^3} = -.083$$

$$-Q_G = \frac{(-.125 \times 30 -.0443 \times -.75)}{2(2 -.0443)} = -0.87$$

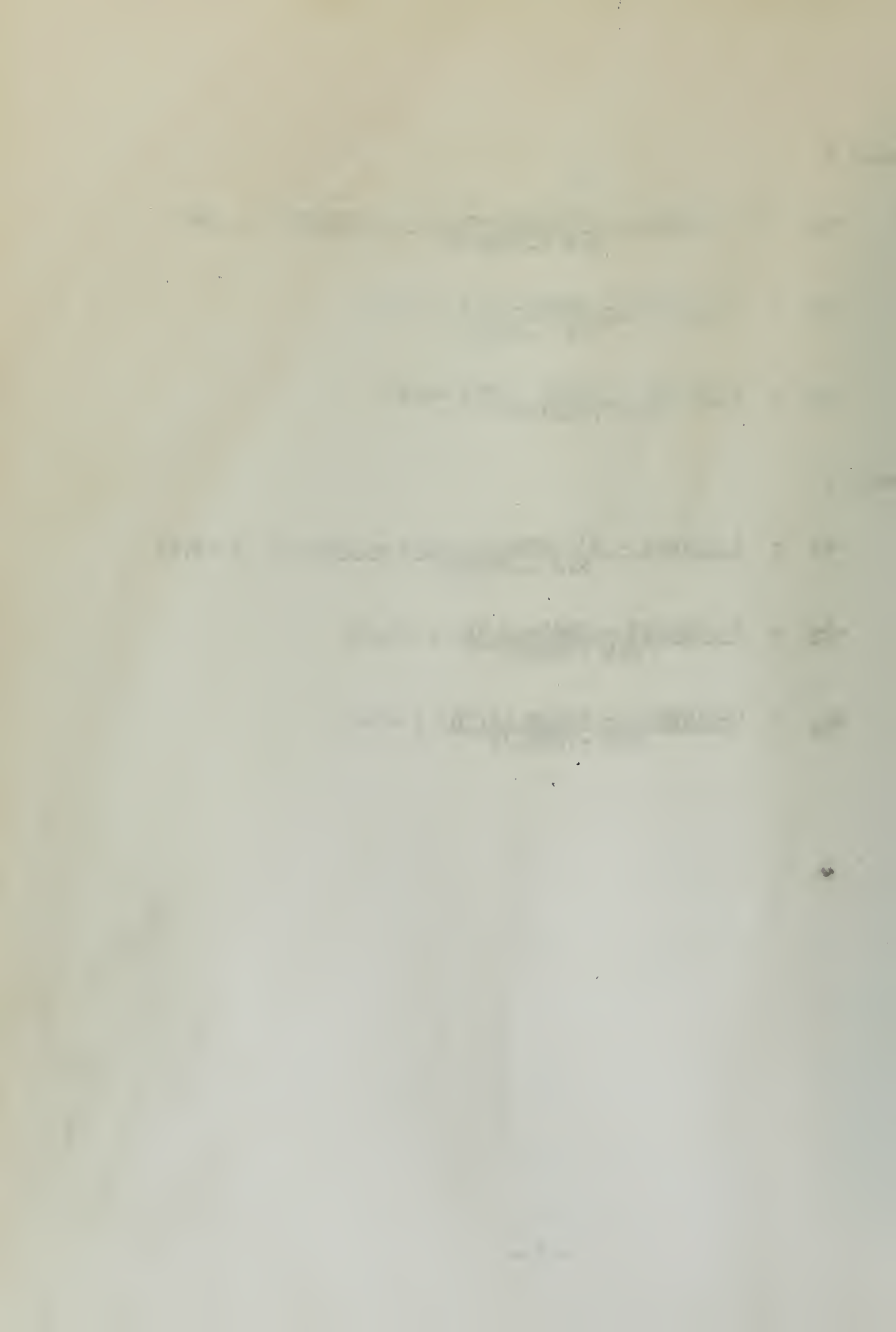
$$-Q_{R7} = \frac{(.125 \times 30 -.0443 \times -.75)}{2(2 -.0443)^5} = -0.29$$

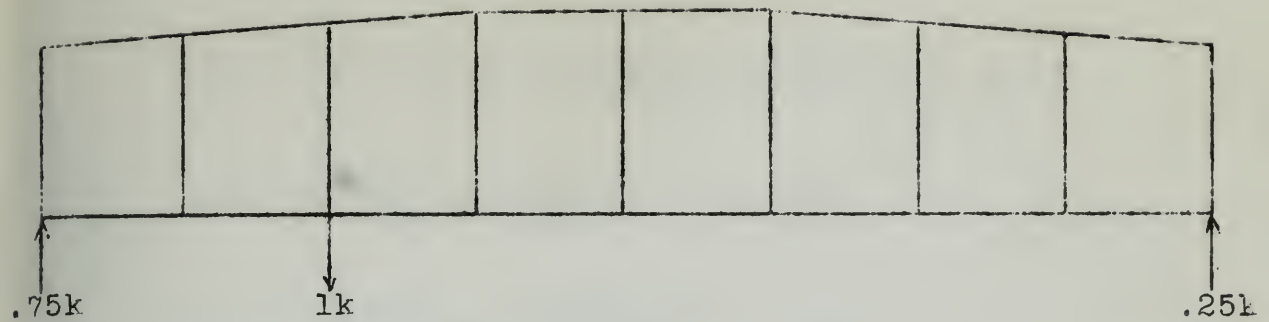
Panel 8

$$-Q_I = \frac{(.0942 \times 4 - 2)(.0861 \times -3.75 - -.125 \times 30)}{2(2 -.0861)^2} = -0.73$$

$$-Q_H = \frac{(-.125 \times 30 -.0861 \times -3.75)}{2(2 -.0861)} = -0.90$$

$$Q_{R8} = \frac{(-.125 \times 30 -.0861 \times -3.75)}{2(2 -.0861)^2} = -0.45$$





.0866	.0443	.0482	0	0	.0482	.0443	.0866
.0942	.0463	.0507	0	0	.0507	.0463	.0942
.75	.75	.25	-.25	-.25	-.25	-.25	-.25
22.5	45.0	37.5	30.0	-30.0	22.5	-15.0	-7.50

Panel 1

$$-Q_A = \frac{(.0942 \times 4 - 2)(.0866 \times 22.5 - .75 \times 30)}{2(2 - .0866)2} = 4.56$$

$$-Q_B = \frac{(.75 \times 30 - .0866 \times 22.5)}{2(2 - .0866)} = 5.38$$

$$Q_{R1} = \frac{(.75 \times 30 - .0866 \times 22.5)}{2(2 - .0866)2} = 2.69$$

Panel 2

$$-Q_B = \frac{(.0463 \times 3 - 3)(.0443 \times 45 - .75 \times 30)}{2(2 - .0443)3} = 4.98$$

$$-Q_C = \frac{(.75 \times 30 - .0443 \times 45)}{2(2 - .0443)} = 5.23$$

$$Q_{R2} = \frac{(.75 \times 30 - .0443 \times 45)}{2(2 - .0443)3} = 1.74$$

$$x_p = \frac{1}{2} \left(x_1 + x_2 + \dots + x_n \right) = \frac{1}{2} \left(x_1 + x_2 + \dots + x_n \right) = \frac{1}{2} \left(x_1 + x_2 + \dots + x_n \right)$$

Panel 3

$$-Q_C = \frac{(.0507 \times 2 - 4)(.0482 \times 37.5 + .25 \times 30)}{2(2 - .0482)4} = -2.33$$

$$-Q_D = \frac{(-.25 \times 30 - .0482 \times 37.5)}{2(2 - .0482)} = -2.38$$

$$Q_{R3} = \frac{(-.25 \times 30 - .0482 \times 37.5)}{2(2 - .0482)4} = -.59$$

Panel 4

$$-Q_D = \frac{-4(0 + .25 \times 30)}{4 \times 4} = -1.87$$

$$-Q_E = \frac{(-.25 \times 30 - 0)}{4} = -1.87$$

$$Q_R = \frac{(-.25 \times 30 - 0)}{4 \times 4} = -.47$$

Note: The only term that changes is $(H_1 L_1 - m M_1)$ and since this is doubled when the load is at panel point 2, it is tripled when the load is at panel point 3, etc. The following constants are derived by multiplying those obtained when the load was at PPl by the factors 2, 3, & 4.

Panel 5

$$-Q_L = -1.88$$

$$-Q_F = -1.88$$

$$Q_{R5} = -.47$$

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Panel 6

$$-Q_G = -1.60$$

$$-Q_F = -1.64$$

$$Q_{R6} = -.41$$

Panel 7

$$-Q_H = -1.67$$

$$-Q_G = -1.75$$

$$Q_{R7} = -0.58$$

Panel 8

$$-Q_I = -1.45$$

$$-Q_H = -1.79$$

$$Q_{R8} = -0.90$$

Load at PP3

Panel 5

$$-Q_E = -2.81$$

$$-Q_F = -2.81$$

$$Q_{R5} = -0.70$$

Panel 6

$$-Q_F = -2.47$$

$$-Q_G = -2.40$$

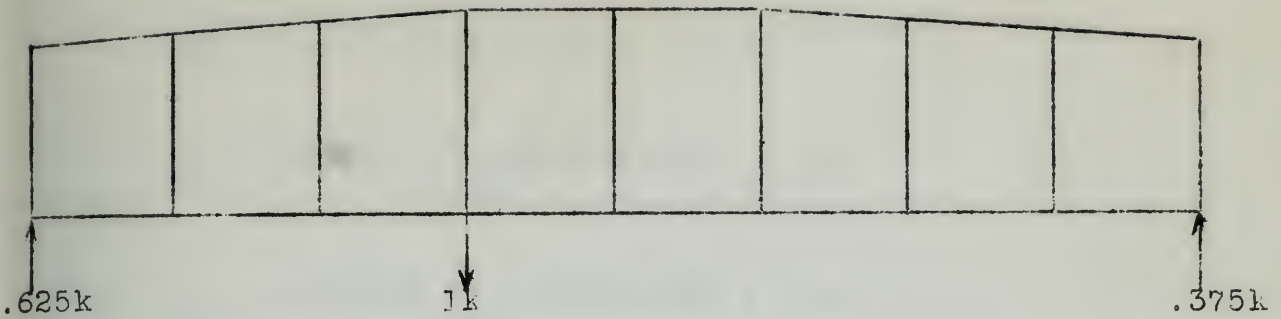
$$Q_{R6} = -0.62$$

Panel 7

$$-Q_G = -2.62$$

$$-Q_H = -2.50$$

$$Q_{R7} = -0.87$$



.0866	.0443	.0482	0	0	.0482	.0443	.0866
.0942	.0463	.0507	0	0	.0507	.0463	.0942
.625	.625	.625	-.375	-.375	-.375	-.375	-.375
18.75	37.5	56.25	45.0	-45.0	-33.75	-22.5	-11.25

Panel 1

Formulae (110f) & (122a) modified by the application of constants for terms involving only M, n, K₁, and K₂. These constants found and checked in solution for two previous loadings.

$$-Q_A = (-.222)(.0866 \times 18.75 - .625 \times 30) = 3.81$$

$$-Q_B = \frac{(.625 \times 30 - .0866 \times 18.75)}{3.82} = 4.49$$

$$Q_{R1} = \frac{(.625 \times 30 - .0482 \times 56.25)}{7.64} = 2.24$$

Panel 2

$$-Q_B = (-.243)(.0443 \times 37.5 - .625 \times 30) = 4.16$$

$$-Q_C = \frac{(.625 \times 30 - .0443 \times 37.5)}{3.92} = 4.36$$

$$Q_{R2} = \frac{(.625 \times 30 - .0443 \times 37.5)}{11.77} = 1.48$$

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Panel 3

$$-Q_C = (-.25)(.0482 \times 56.25 - .625 \times 30) = 4.02$$

$$-Q_D = \frac{(.625 \times 30 - .0482 \times 56.25)}{(3.90)} = 4.12$$

$$Q_{R_3} = \frac{(.625 \times 30 - .0482 \times 56.25)}{15.60} = 1.03$$

Panel 4

$$-Q_D = (-.25)(0 - .375 \times 30) = -2.81$$

$$-Q_E = \frac{(-.375 \times 30 - 0)}{4} = -2.81$$

$$Q_{R_4} = \frac{(-.375 \times 30 - 0)}{4 \times 4} = -.70$$

Panel 5

$$-Q_E = -3.75$$

$$-Q_F = -3.75$$

$$Q_{R_5} = -0.938$$

Panel 6

$$-Q_F = -3.288$$

$$-Q_G = -3.204$$

$$Q_{R_6} = -0.82$$

Panel 7

$$-Q_G = -3.496$$

$$-Q_H = -3.332$$

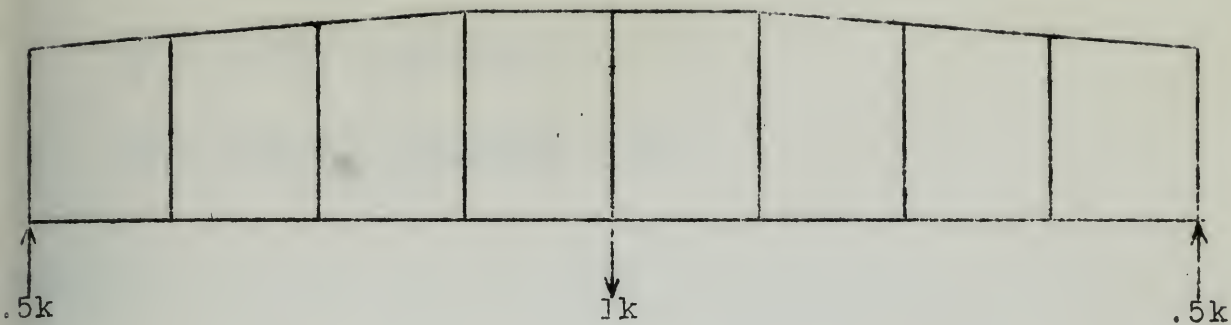
$$Q_{R7} = -1.164$$

Panel 8

$$-Q_H = -3.584$$

$$-Q_I = -2.908$$

$$Q_{R8} = -1.792$$



.0866	.0482	.0482	0	0	.0482	.0443	.0866
.0942	.0463	.0507	0	0	.0507	.0463	.0942
.5	.5	.5	.5	-.5	-.5	-.5	-.5
15	30	45	60	-60	-45	-30	-15

Panel 1

$$-Q_A = (-.222)(.0866 \times 15 - .5 \times 30) = 3.04$$

$$-Q_B = \frac{(.5 \times 30 - .0866 \times 15)}{3.82} = 3.59$$

$$Q_{R1} = \frac{(.5 \times 30 - .0866 \times 15)}{7.64} = 1.79$$

Panel 2

$$-Q_B = (-.243)(.0443 \times 30 - .5 \times 30) = 3.32$$

$$-Q_C = \frac{(.5 \times 30 - .0443 \times 30)}{3.92} = 3.49$$

$$Q_{R2} = \frac{(.5 \times 30 - .0443 \times 30)}{11.76} = 1.16$$

Panel 3

$$-Q_C = (-.25)(.0482 \times 45 - .5 \times 30) = 3.21$$

$$-Q_D = \left(\frac{.5 \times 30 - .0482 \times 45}{3.90} \right) = 3.30$$

$$Q_{R3} = \left(\frac{.5 \times 30 - .0482 \times 45}{15.60} \right) = .82$$

Panel 4

$$-Q_D = (-.25)(0 - .5 \times 30) = 3.75$$

$$-Q_E = \left(\frac{.5 \times 30 - 0}{4} \right) = 3.75$$

$$Q_{R4} = \left(\frac{.5 \times 30 - 0}{4 \times 4} \right) = .94$$

Panel 5

$$-Q_E = -2.31$$

$$-Q_F = -2.81$$

$$Q_{R5} = -0.70$$

Panel 6

$$-Q_F = -2.47$$

$$-Q_G = -2.40$$

$$Q_{R6} = -0.62$$

Panel 7

$$-Q_G = -2.62$$

$$-Q_H = -2.50$$

$$Q_{R7} = -0.87$$

Panel 8

$$-Q_H = -2.18$$

$$-Q_I = -2.67$$

$$Q_{R8} = -1.34$$

1. The first part of the paper is devoted to a general discussion of the problem.

2. In the second part, we consider the case of a single particle.

3. The third part is devoted to the case of a system of particles.

4. In the fourth part, we consider the case of a continuous medium.

5. The fifth part is devoted to the case of a system of continuous media.

6. In the sixth part, we consider the case of a system of particles and continuous media.

7. The seventh part is devoted to the case of a system of particles and continuous media.

8. In the eighth part, we consider the case of a system of particles and continuous media.

9. The ninth part is devoted to the case of a system of particles and continuous media.

10. In the tenth part, we consider the case of a system of particles and continuous media.

11. The eleventh part is devoted to the case of a system of particles and continuous media.

12. In the twelfth part, we consider the case of a system of particles and continuous media.

13. The thirteenth part is devoted to the case of a system of particles and continuous media.

14. In the fourteenth part, we consider the case of a system of particles and continuous media.

15. The fifteenth part is devoted to the case of a system of particles and continuous media.

INFLUENCE LINES - JOINT CONSTANTS

LOAD AT B

Panel 1

$$\left[1.5x4 + 2 + \frac{(3-.0866)(.0942x4-2)}{2(2-.0866)} \right] A + \left[1 + \frac{(3-.17)(.0942x4-2)}{2(2-.0866)} \right] B = -Q$$

$$6.77A - .25B = 5.32$$

$$\left[2 + 1.5 \times 3 - \frac{(3-.17)2}{2(2-.0866)} \right] B + \left[\frac{2}{3} - \frac{(3-.0866)2}{2(2-.0866)} \right] A = -Q_B$$

$$5.02B - .52A = 6.27$$

Solving Simultaneously

$$A = 0.82$$

$$B = 1.33$$

$$R_1 = \frac{(3-.0866).82 + (3-.17)1.33 + 3.14}{2(2-.0866)} = 4.76$$

Panel 2

$$\left[1.5x3 + 3 + \frac{(3-.0443)(.0463x3-3)}{2(2-.0443)} \right] B + \left[\frac{3}{2} + \frac{(3-.09)(.0463x3-3)}{2(2-.0443)} \right] C = -Q_B$$

$$5.34B - .62C = -1.16$$

$$\left[3 + 1.5x2 - \frac{(3-.0886)3}{2(2-.0443)} \right] C + \left[\frac{3}{2} - \frac{(3-.0443)3}{2(2-.0443)} \right] B = -Q_C$$

$$3.77C - .76B = -1.21$$

Solving Simultaneously

$$B = -.26$$

$$C = -.37$$

$$R_2 = \frac{(3-.0443)(-.26) + (3-.09)(-.37) - .40}{2(2-.0443)} = -.87$$

Panel 3

$$\left[1.5x2 + 4 + \frac{(3-.0482)(.0507x2-4)}{2(2-.0482)} \right] C + \left[2 + \frac{(3-.0964)(.0507x2-4)}{2(2-.0482)} \right] D = -Q_C$$

$$4.05 C - .9 D = -1.16$$

$$\left[4 + 1.5 - \frac{(3-.0964)4}{2(2-.0482)} \right] D + \left[2 - \frac{(3-.0482)4}{2(2-.0482)} \right] C = -Q_D$$

$$2.53 D - 1.02 C = 1.19$$

Solving Simultaneously

$$\begin{aligned} C &= -.43 \\ D &= -.64 \end{aligned}$$

$$R_3 = \frac{(3-.0482)(-.43) + (3-.0964)(-.64)}{2(2-.0482)} - .30 = -1.10$$

Panel 4

$$\left[1.5x1 + 4 + \frac{3(-4)}{4} \right] D + \left[2 + \frac{3(-4)}{4} \right] E = -Q_D$$

$$2.5 D - 1 E = -.94$$

$$\left[4 + 1.5x1 - \frac{3x4}{4} \right] E + \left[2 - \frac{3x4}{4} \right] D = -Q_E$$

$$2.5 E - 1 D = -.94$$

Solving Simultaneously

$$\begin{aligned} D &= -.63 \\ E &= -.63 \end{aligned}$$

$$R_4 = \frac{3(-.63) + 3(-.63)}{4} - .23 = -1.18$$

Panel 5

$$\left[1.5 \times 1 + \frac{4}{4} \right] F - \frac{4}{4} E = -.94$$

$$\left[1.5 \times 1 + \frac{4}{4} \right] E - \frac{4}{4} F = -.94$$

$$E = -.63$$

$$F = -.63$$

$$R_5 = \frac{3}{4} (-.63 - .63) -.23 = -.94 -.23 = -1.17$$

Panel 6

$$\left[1.5 \times 2 + 4 + \frac{(3-.0482)(.0507 \times 2 - 4)}{2(2-.0482)} \right] G$$

$$+ \left[\frac{4}{2} + \frac{(3 - 2 \times .0482)(.0507 \times 2 - 4)}{2(2-.0482)} \right] F = -.80$$

$$4.06 G - 0.89 F = -.80$$

$$\left[4 + 1.5 \times 1 - \frac{(3-2 \times .0482)4}{2(2-.0482)} \right] F + \left[\frac{4}{2} - \frac{(3-.0482)4}{2(2-.0482)} \right] G = -.82$$

$$2.53 F - 1.02 G = -.82$$

Solving Simultaneously

$$F = -.47$$

$$G = -.30$$

$$R_6 = \frac{-(3-.0482) \times .30 - (3-2 \times .0482) \times .47}{2(2-.0482)} -.21 = -.78$$

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Panel 7

$$\left[1.5 \times 3 + 3 + \frac{(3-.0443)(.0463 \times 3 - 3)}{2(2-.0443)} \right] H$$

$$+ \left[\frac{3}{2} + \frac{(3-2 \times .0443)(.0463 \times 3 - 3)}{2(2-.0443)} \right] G = -0.83$$

$$5.34 H - .62 G = -.83$$

$$\left[3 + 1.5 \times 2 - \frac{(3-2 \times .0443)3}{2(2-.0443)} \right] G + \left[\frac{3}{2} - \frac{(3-.0433)3}{2(2-.0433)} \right] H = -.87$$

$$3.77 G - .76 H = -.87$$

Solving Simultaneously

$$G = -.27$$

$$H = -.19$$

$$R_7 = - \frac{(3-.0443) \times .19 + (3-2 \times .0443) \times -.27}{2(2-.0443)} - 0.29 = -.63$$

Panel 8

$$\left[1.5 \times 4 + 2 + \frac{(3-.0866)(.0942 \times 4 - 2)}{2(2-.0866)} \right] I + \left[\frac{2}{2} + \frac{(3-2 \times .0866)(.0942 \times 4 - 2)}{2(2-.0866)} \right] H$$

$$= -.73$$

$$6.77 I - .20 H = -.73$$

$$\left[2 + 1.5 \times 3 - \frac{(3-2 \times .0866)2}{2(2-.0866)} \right] H + \left[\frac{2}{2} - \frac{(3-.0866)2}{2(2-.0866)} \right] I$$

$$5.02 H - .52 I = -.49$$

Solving Simultaneously

$$H = -0.21$$

$$I = -0.11$$

$$R_8 = - \frac{(3-.0866) \times .11 - (3-2 \times .0866) \times -.21}{2(2-.0861)} - 0.49 = .73$$

1. The first part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

$$f(x) = \frac{1}{2} \left(f\left(\frac{x}{2}\right) + f\left(\frac{x+1}{2}\right) \right)$$

where $f(x)$ is a function defined on the interval $[0, 1]$.

It is easy to see that the function $f(x)$ is continuous on the interval $[0, 1]$ and that it satisfies the condition

$$f(0) = \frac{1}{2} \left(f\left(\frac{0}{2}\right) + f\left(\frac{0+1}{2}\right) \right) = \frac{1}{2} \left(f(0) + f\left(\frac{1}{2}\right) \right)$$

$$f\left(\frac{1}{2}\right) = 2f(0)$$

$$\text{Hence, } f\left(\frac{1}{2}\right) = 2f(0) \Rightarrow f(0) = \frac{1}{3} \left(f\left(\frac{1}{2}\right) + f\left(\frac{1}{2}\right) \right) = \frac{2}{3} f\left(\frac{1}{2}\right)$$

$$\Rightarrow f\left(\frac{1}{2}\right) = \frac{3}{2} f(0)$$

$$\Rightarrow f(0) = \frac{1}{3} \left(\frac{3}{2} f(0) + \frac{3}{2} f(0) \right) = f(0)$$

$$f(0) = \frac{1}{3}$$

$$\text{Thus, } f(0) = \frac{1}{3} \Rightarrow f\left(\frac{1}{2}\right) = \frac{3}{2} f(0) = \frac{1}{2}$$

$$f\left(\frac{1}{4}\right) = \frac{1}{2} \left(f\left(\frac{1}{8}\right) + f\left(\frac{5}{8}\right) \right)$$

$$\Rightarrow f\left(\frac{1}{4}\right) = \frac{1}{2} \left(\frac{1}{8} + \frac{5}{8} \right) = \frac{3}{8}$$

$$f\left(\frac{3}{4}\right) = \frac{1}{2} \left(f\left(\frac{3}{8}\right) + f\left(\frac{7}{8}\right) \right)$$

$$\Rightarrow f\left(\frac{3}{4}\right) = \frac{1}{2} \left(\frac{3}{8} + \frac{7}{8} \right) = \frac{5}{8}$$

$$\text{Hence, } f\left(\frac{1}{4}\right) = \frac{3}{8} \text{ and } f\left(\frac{3}{4}\right) = \frac{5}{8}$$

$$f\left(\frac{1}{8}\right) = \frac{1}{2} \left(f\left(\frac{1}{16}\right) + f\left(\frac{5}{16}\right) \right)$$

$$\Rightarrow f\left(\frac{1}{8}\right) = \frac{1}{2} \left(\frac{1}{16} + \frac{5}{16} \right) = \frac{3}{16}$$

$$f\left(\frac{7}{8}\right) = \frac{1}{2} \left(f\left(\frac{7}{16}\right) + f\left(\frac{15}{16}\right) \right)$$

$$\Rightarrow f\left(\frac{7}{8}\right) = \frac{1}{2} \left(\frac{7}{16} + \frac{15}{16} \right) = \frac{11}{16}$$

$$\text{Thus, } f\left(\frac{1}{8}\right) = \frac{3}{16} \text{ and } f\left(\frac{7}{8}\right) = \frac{11}{16}$$

Influence Lines - Joint Constants

Load at C

Panel 1

$$6.77A - .2 B = 4.56$$

$$-.52A + 5.02B = 5.38$$

Solving Simultaneously

$$A = .71$$

$$B = 1.14$$

$$R_1 = \frac{(3 - .0866) \cdot .71 + (3 - .17) \cdot 1.14}{2(2 - .0866)} + 2.69 = 4.07$$

Panel 2

$$5.34B - .62C = 4.98$$

$$3.77C - .76B = 5.23$$

Solving Simultaneously

$$B = 1.14$$

$$C = 1.62$$

$$R_2 = \frac{(3 - .0443)B + (3 - .0886)C}{2(2 - .0443)} + 1.76 = 3.80$$

Panel 3

$$4.05C - .9 D = -2.23$$

$$2.53D - 1.02C = -1.19$$

Solving Simultaneously

$$C = -.72$$

$$D = -.76$$

$$R_3 = \frac{(3 - .0482)(-.72) + (3 - .0964)(-.76)}{2(2 - .0482)} - .59 = -1.70$$

Panel 4

$$2.5D - 1E = -1.87$$

$$2.5E - 1D = -1.87$$

Solving Simultaneously

$$D = -1.25$$

$$E = -1.25$$

$$R_4 = \frac{3(-1.25) + 3(-1.25)}{4} - .47 = -2.34$$

Panel 5

$$E = -1.25$$

$$F = -1.25$$

$$R_5 = -2.34$$

Panel 6

$$F = -0.94$$

$$G = -0.60$$

$$R_6 = -1.56$$

Panel 7

$$G = -0.54$$

$$H = -0.37$$

$$R_7 = -1.27$$

Panel 8

$$H = -0.41$$

$$I = -0.23$$

$$R_8 = -1.45$$

Influence Lines - Joint Constants

Load at D

Panel 1

$$6.77A - .2 B = 3.81$$

$$-.52A + 5.02B = 4.49$$

Solving Simultaneously

$$A = .59$$

$$B = .96$$

$$R_1 = \frac{(3 - .0866) .59 + (3 - .17) .96}{2(2 - .0866)} + 2.24 = 3.40$$

Panel 2

$$5.34B - .62C = 4.16$$

$$3.77C - .76B = 4.36$$

Solving Simultaneously

$$B = .94$$

$$C = 1.34$$

$$R_2 = \frac{(3 - .0443)B + (3 - .0886)C}{2(2 - .0443)} + 1.48 = 3.18$$

Panel 3

$$4.05C - .9D = 4.02$$

$$2.53D - 1.02C = 4.12$$

Solving Simultaneously

$$C = 1.49$$

$$D = 2.23$$

$$R_3 = \frac{(3 - .0482)1.49 + (3 - .0964)2.23}{2(2 - .0482)} + 1.03 = 3.81$$

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Panel 4

$$2.5D - 1E = -2.81$$

$$2.5E - 1D = -2.81$$

Solving Simultaneously

$$D = -1.87$$

$$E = -1.87$$

$$R_4 = \frac{3(-1.87) + 3(-1.87)}{4} + .70 = -3.51$$

Panel 5

$$E = -1.88$$

$$F = -1.88$$

$$R_5 = -3.52$$

Panel 6

$$F = -1.41$$

$$G = -0.90$$

$$R_6 = -2.34$$

Panel 7

$$G = -0.81$$

$$H = -0.56$$

$$R_7 = -1.90$$

Panel 8

$$H = -0.62$$

$$I = -0.34$$

$$R_8 = -2.18$$

Influence Lines - Joint Constants

Load at E

Panel 1

$$6.77A - .2B = 3.04$$

$$-.52A + 5.02B = 3.59$$

Solving Simultaneously

$$A = .47$$

$$B = .76$$

$$R_1 = \frac{(3 - .0866).47 + (3 - .17).76}{2(2 - .0866)} + 1.79 = 2.71$$

Panel 2

$$5.34B - .62C = 3.32$$

$$3.77C - .76B = 3.49$$

Solving Simultaneously

$$B = .75$$

$$C = 1.08$$

$$R_2 = \frac{(3 - .0443)B + (3 - .0866)C}{2(2 - .0433)} + 1.16 = 2.53$$

Panel 3

$$4.05C - .9D = 3.21$$

$$2.53D - 1.02C = 3.30$$

Solving Simultaneously

$$C = 1.19$$

$$D = 1.78$$

$$R_3 = \frac{(3 - .0482)1.19 + (3 - .0964)1.78}{2(2 - .0482)} + .82 = 3.04$$

Panel 4

$$2.5D - 1E = 3.75$$

$$2.5E - 1D = 3.75$$

Solving Simultaneously

$$D = 2.5$$

$$E = 2.5$$

$$R_4 = \frac{3(2.5) + 3(2.5)}{4} + .94 = 4.69$$

Panel 5

$$E = -2.50$$

$$F = -2.50$$

$$R_5 = -4.69$$

Panel 6

$$F = -1.88$$

$$G = -1.20$$

$$R_6 = -3.12$$

Panel 7

$$G = -1.08$$

$$H = -.75$$

$$R_7 = 2.53$$

Panel 8

$$H = -.83$$

$$I = -.45$$

$$R_8 = -2.91$$

1. The first part of the paper is devoted to a general discussion of the problem of the existence of solutions of the system of equations (1) and (2) under the conditions (3) and (4).

2. In the second part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

3. In the third part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

4. In the fourth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

5. In the fifth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

6. In the sixth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

7. In the seventh part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

8. In the eighth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

9. In the ninth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

10. In the tenth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

11. In the eleventh part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

12. In the twelfth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

13. In the thirteenth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

14. In the fourteenth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

15. In the fifteenth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

16. In the sixteenth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

17. In the seventeenth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

18. In the eighteenth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

19. In the nineteenth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

20. In the twentieth part we shall consider the case of the system of equations (1) and (2) under the conditions (3) and (4).

Influence Lines - Moment Determination

Load at B

Panel 1

$$M_{AB} = 2\left(.82 + \frac{1.33}{2} - 4.76\right) = -6.56$$

$$M_{BA} = 2\left(1.33 + \frac{.82}{2} - 4.76\right) = -6.04$$

Panel 2

$$M_{BC} = 3\left(-.26 - \frac{.37}{2} + .87\right) = +1.29$$

$$M_{CB} = 3\left(-.37 - \frac{.26}{2} + .87\right) = +1.11$$

Panel 3

$$M_{CD} = 4\left(-.43 - \frac{.64}{2} + 1.10\right) = +1.40$$

$$M_{DC} = 4\left(-.64 - \frac{.43}{2} + 1.10\right) = +1.10$$

Panel 4

$$M_{DE} = 4\left(-.63 - \frac{.63}{2} + 1.18\right) = +.96$$

$$M_{ED} = 4\left(-.63 - \frac{.63}{2} + 1.18\right) = +.96$$

Panel 5

$$M_{EF} = 4\left(-.63 - \frac{.63}{2} + 1.17\right) = +0.94$$

$$M_{FE} = 4\left(-.63 - \frac{.63}{2} + 1.17\right) = +0.94$$

Panel 6

$$M_{FG} = 4(-.47 - \frac{.30}{2} + .78) = +0.64$$

$$M_{GF} = 4(-.30 - \frac{.47}{2} + .78) = +0.98$$

Panel 7

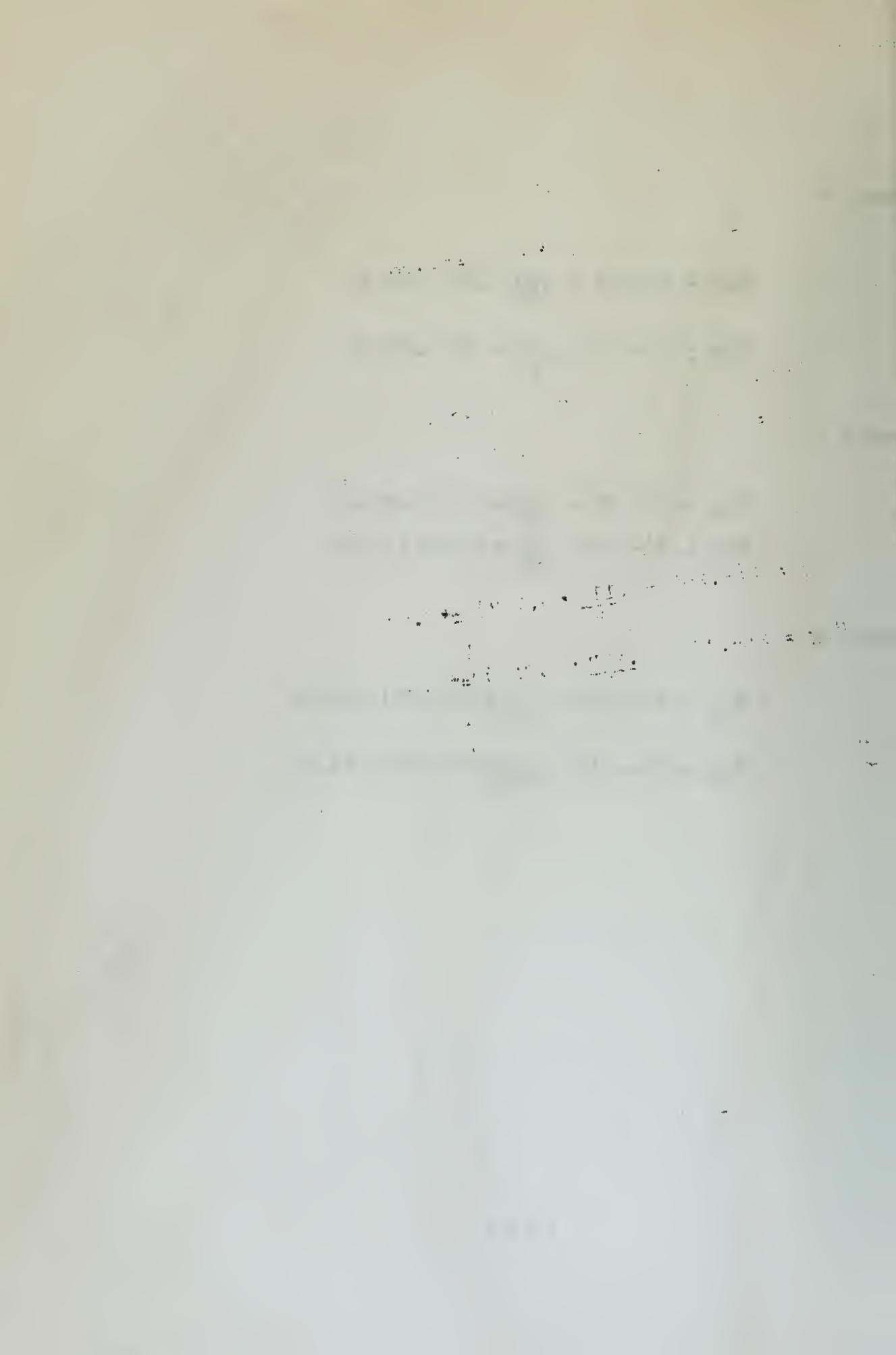
$$M_{GH} = 3(-.27 - \frac{.19}{2} + 0.63) = +0.81$$

$$M_{HG} = 3(-.19 - \frac{.27}{2} + 0.63) = +0.93$$

Panel 8

$$M_{HI} = 2(-.207 - \frac{.113}{2} + 0.727) = +0.93$$

$$M_{IH} = 2(-.113 - \frac{.207}{2} + 0.727) = +1.02$$



Influence Lines - Moment Determination

Load at C

Panel 1

$$M_{AB} = 2\left(\cancel{.71} + \frac{1.14}{2} - 4.07\right) = -5.58$$

$$M_{BA} = 2\left(1.14 + \frac{\cancel{.71}}{2} - 4.07\right) = -5.16$$

Panel 2

$$M_{BC} = 3\left(1.14 + \frac{1.62}{2} - 3.80\right) = -5.55$$

$$M_{CB} = 3\left(1.62 + \frac{1.14}{2} - 3.80\right) = -4.83$$

Panel 3

$$M_{CD} = 4\left(\cancel{-.72} - \frac{.76}{2} + 1.70\right) = \cancel{+}2.40$$

$$M_{DC} = 4\left(\cancel{-.76} - \frac{.72}{2} + 1.70\right) = \cancel{+}2.32$$

Panel 4

$$M_{DE} = 4\left(\cancel{-1.25} - \frac{1.25}{2} + 2.34\right) = \cancel{+}1.88$$

$$M_{ED} = 4\left(\cancel{-1.25} - \frac{1.25}{2} + 2.34\right) = \cancel{+}1.88$$

Panel 5

$$M_{EF} = 1.88$$

$$M_{FE} = 1.88$$

Panel 6

$$M_{FG} = 1.29$$

$$M_{GF} = 1.96$$

Panel 7

$$M_{GH} = 1.62$$

$$M_{HG} = 1.87$$

Panel 8

$$M_{HI} = 1.85$$

$$M_{IH} = 2.04$$

Influence Lines - Moment Determination

Load at D

Panel 1

$$M_{AB} = 2(.59 + \frac{.96}{2} - 3.40) = -4.66$$

$$M_{BA} = 2(.96 + \frac{.59}{2} - 3.40) = -4.30$$

Panel 2

$$M_{BC} = 3(.94 + \frac{1.34}{2} - 3.18) = -4.71$$

$$M_{CB} = 3(1.34 + \frac{.94}{2} - 3.18) = -4.11$$

Panel 3

$$M_{CD} = 4(1.49 + \frac{2.23}{2} - 3.81) = -4.84$$

$$M_{DC} = 4(2.23 + \frac{1.49}{2} - 3.81) = -3.36$$

Panel 4

$$M_{DE} = 4(-1.87 - \frac{1.87}{2} + 3.51) = +2.84$$

$$M_{ED} = 4(-1.87 - \frac{1.87}{2} + 3.51) = +2.84$$

Panel 5

$$M_{EF} = 2.81$$

$$M_{FE} = 2.81$$

Panel 6

$$M_{FG} = 1.93$$

$$M_{GF} = 2.94$$

Panel 7

$$M_{GH} = 2.43$$

$$M_{HG} = 2.80$$

Panel 8

$$M_{HI} = 2.78$$

$$M_{IH} = 3.06$$

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Influence Lines - Moment Determination

Load at E

Panel 1

$$M_{AB} = 2(.47 + \frac{.76}{2} - 2.79) = -3.88$$

$$M_{BA} = 2(.76 + \frac{.47}{2} - 2.79) = -3.60$$

Panel 2

$$M_{BC} = 3(.75 + \frac{1.08}{2} - 2.53) = -3.72$$

$$M_{CB} = 3(1.08 + \frac{.75}{2} - 2.53) = -3.24$$

Panel 3

$$M_{CD} = 4(1.19 + \frac{1.78}{2} - 3.04) = -3.84$$

$$M_{DC} = 4(1.78 + \frac{1.19}{2} - 3.04) = -2.68$$

Panel 4

$$M_{DE} = 4(2.5 + \frac{2.5}{2} - 4.69) = -3.76$$

$$M_{ED} = 4(2.5 + \frac{2.5}{2} - 4.69) = -3.76$$

Panel 5

$$M_{EF} = 3.75$$

$$M_{FE} = 3.75$$

Panel 6

$$M_{FG} = 2.58$$

$$M_{GF} = 3.92$$

Panel 7

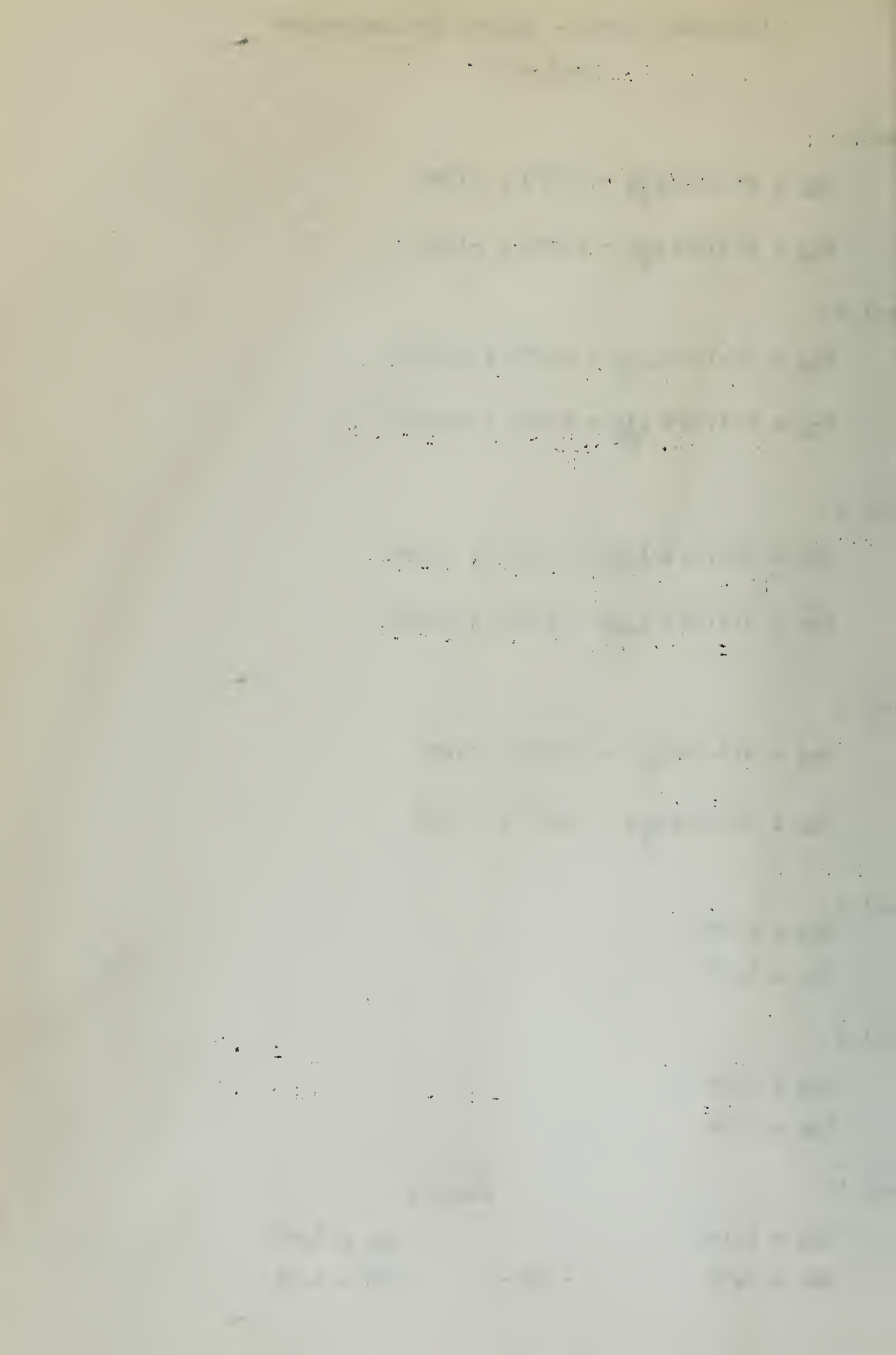
$$M_{GH} = 3.24$$

$$M_{HG} = 3.73$$

Panel 8

$$M_{HI} = 3.60$$

$$M_{IH} = 4.08$$



First Moment Corrections - Load at B

Panel 1

$$6.77A - .20B = 0 \quad A = -.01$$

$$-0.52A + 5.02B = -1.29 \quad B = -.25$$

$$R_1 = \frac{-2.91 \times .01 - 2.83 \times .25}{3.83} = -.19$$

$$M_{AB} = 2(-.01 - \frac{.25}{2} + .19) = .12$$

$$M_{BA} = 2(-.25 - \frac{.01}{2} + .19) = -.12$$

Panel 2

$$5.34B - .63C = 6.04 \quad B = 1.11$$

$$-0.77B + 3.77C = -1.40 \quad C = -0.14$$

$$R_2 = \frac{2.96 \times 1.11 - 2.91 \times .14}{3.91} = .74$$

$$M_{BC} = 2(1.11 - \frac{.14}{2} + 0.74) = .60$$

$$M_{CB} = 2(-.14 + \frac{1.11}{2} + 0.74) = -.64$$

Panel 3

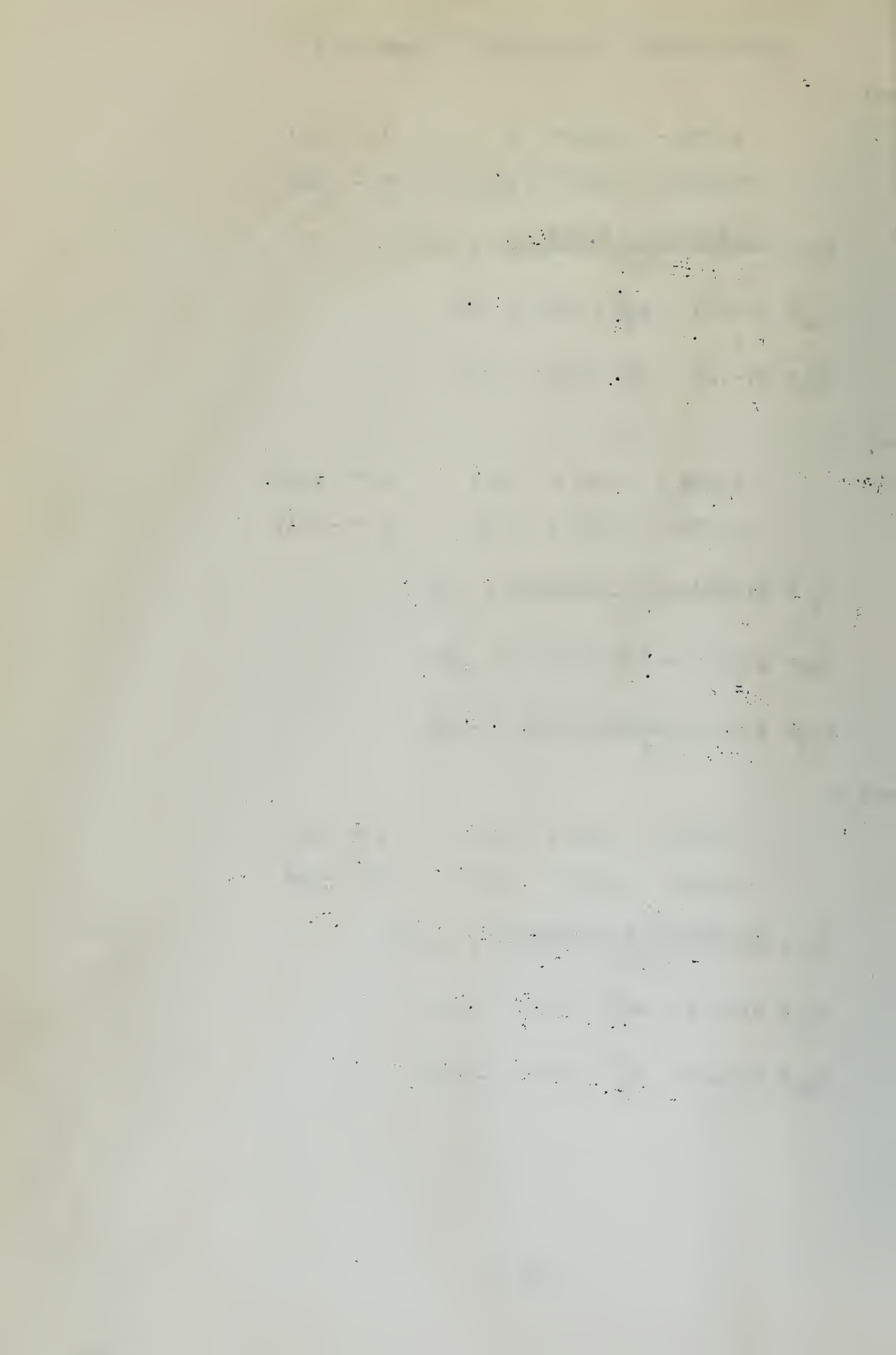
$$4.06C - .89D = -1.11 \quad C = -.39$$

$$-1.02C + 2.53D = -.96 \quad D = -.54$$

$$R_3 = \frac{-2.95 \times .39 - 2.90 \times .54}{3.90} = -.70$$

$$M_{CD} = 3(-.39 - \frac{.54}{2} + .70) = .12$$

$$M_{DC} = 3(-.54 - \frac{.39}{2} + .70) = -.12$$



Panel 4

$$\begin{aligned} 2.5 D - E &= -1.10 \\ -0 + 2.5 E &= -.96 \\ D &= -.71 \\ E &= -.67 \end{aligned}$$

$$R_4 = \frac{3}{4} (-.67 - .71) = -1.03$$

$$M_{DE} = 4(-.71 - \frac{.67}{2} + 1.03) = -.08$$

$$M_{ED} = 4(-.67 - \frac{.71}{2} + 1.03) = .04$$

Panel 5

$$\begin{aligned} 2.5 E - F &= -.64 \\ -E + 2.5 F &= -.96 \\ E &= -.49 \\ F &= -.58 \end{aligned}$$

$$R_5 = \frac{3}{4} (-.58 - .49) = -.80$$

$$M_{EF} = 4(-.49 - \frac{.58}{2} + .80) = .08$$

$$M_{FE} = 4(-.58 - \frac{.49}{2} + .80) = -.12$$

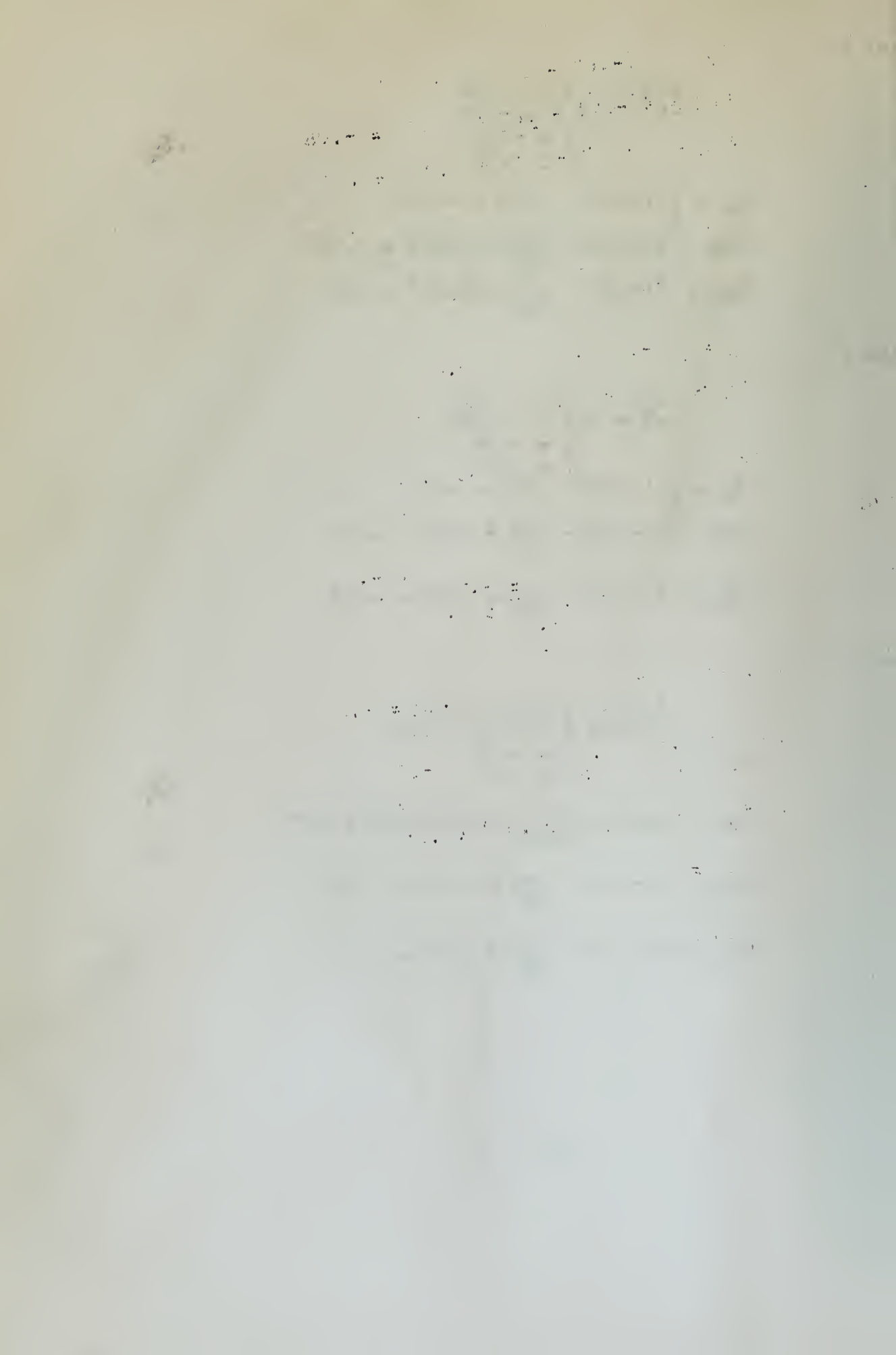
Panel 6

$$\begin{aligned} 4.06 - 0.89 F &= -.81 \\ -1.026 + 2.53 F &= -.96 \\ F &= -.50 \\ G &= -.31 \end{aligned}$$

$$R_6 = \frac{-2.95 \times .31 - 2.90 \times .50}{3.90} = -.61$$

$$M_{FG} = 3(-.50 - \frac{.31}{2} + .61) = -.15$$

$$M_{GF} = 3(-.31 - \frac{.50}{2} + .61) = .15$$



Panel 7

$$\begin{aligned}5.34 H - 0.63 G &= -.93 \\-0.77 H + 3.77 G &= -.98 \\G &= -.30 \\H &= -.21\end{aligned}$$

$$R_7 = \frac{-2.96 \times .21 - 2.91 \times .3}{3.91} = -.38$$

$$M_{GH} = 2(-.30 - \frac{.21}{2} + .38) = -.06$$

$$M_{HG} = 2(-.21 - \frac{.30}{2} + .38) = .06$$

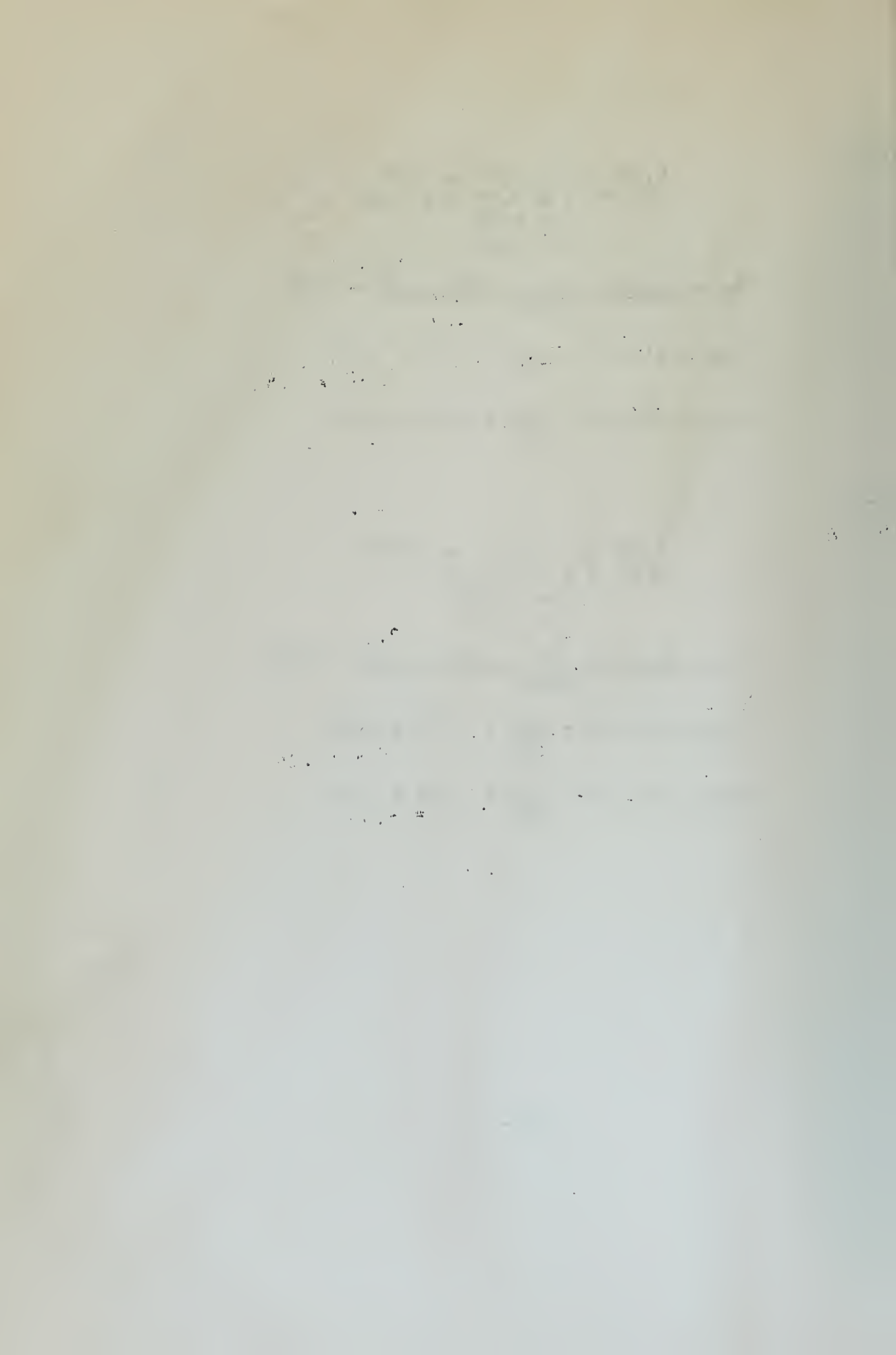
Panel 8

$$\begin{aligned}5.02 H - 0.52 I &= -.0.93 \\-0.20 H + 6.77 I &= 0 \\H &= -0.19 \\I &= -0.01\end{aligned}$$

$$R_8 = \frac{-2.91 \times .01 - 2.83 \times .19}{3.83} = -0.15$$

$$M_{HI} = 2(-.19 - \frac{.01}{2} + .15) = -.08$$

$$M_{IH} = 2(-.01 - \frac{.19}{2} + .15) = .08$$



SECOND MOMENT CORRECTIONS

Load at B

Panel 1

$$\begin{aligned} 6.77 A - 0.20 B &= 0 \\ -0.52 A + 5.02 B &= -.60 \end{aligned}$$

$$\begin{aligned} A &= 0 \\ B &= -.12 \end{aligned}$$

$$R_1 = \frac{-2.83 \times .12}{3.83} = -.09$$

$$M_{AB} = 2\left(0 - \frac{.12}{2} + .09\right) = .06$$

$$M_{BA} = 2(-.12 + .09) = -.06$$

Panel 2

$$5.34 B - 0.63 C = -.12$$

$$-0.77 B + 3.77 C = .12$$

$$B = .03$$

$$C = .04$$

$$R_2 = \frac{-2.96 \times .03 - 2.91 \times .04}{3.91} = -.05$$

$$M_{BC} = 2(-.03 - \frac{.04}{2} + .05) = 0$$

$$M_{CB} = 2(-.04 - \frac{.03}{2} + .05) = -.01$$

Load at PP1

	Panel	1		2		3		4	
		A	B	B	C	C	D	D	E
Initial Values	-Q	+5.32	+6.27	-1.16	-1.21	-1.16	-1.19	-0.94	-0.94
	∞	+1.31	+1.33	-0.26	-0.37	-0.43	-0.64	-0.63	-0.63
	R	+4.76		-0.87		-1.10		-1.18	
	M'	-6.56	-6.04	+1.29	+1.11	+1.40	+1.10	+0.96	+0.96
First Incre- ment	-Q	+0.00	-1.29	+6.04	-1.40	-1.11	-0.96	-1.10	-0.96
	∞	-0.01	-0.25	+1.11	-0.14	-0.39	-0.54	-0.71	-0.67
	R	-0.19		+0.74		-0.70		-1.03	
	M'	+0.12	-0.12	+0.60	-0.64	+ .12	- .12	- .08	+ .04
	-Q	+0.00	-0.60	-0.12	-0.12	+0.64	-0.04	+0.12	+0.12
	∞	+0.00	-0.12	-0.03	-0.04				
	R	-0.09		-0.05					
	M'	+0.06	-0.06	+0.00	-0.01	-	-	-	-
	M	-6.38	-6.22	+1.89	+0.46	+1.52	+0.98	+0.88	+1.00

	5		6		7		8	
	E	F	F	G	G	H	H	I
-Q	-0.94	-0.94	-0.82	-0.80	-0.87	-0.83	-0.90	-0.73
α	-0.63	-0.63	-0.47	-0.30	-0.27	-0.19	-0.21	-0.11
R	-1.18		-0.78		-0.63		-0.73	
M	+0.96	+0.96	+0.64	+0.98	+0.81	+0.93	+0.93	+1.02
-Q	-0.96	-0.64	-0.96	-0.81	-0.98	-0.93	-0.93	+0.00
α	-0.49	-0.58	-0.50	-0.31	-0.30	-0.21	-0.19	-0.01
R	-0.80		-0.61		-0.38		-0.15	
M'	+0.08	-0.12	-0.15	+0.15	-0.06	+0.06	-0.08	+0.08
	+0.08	+0.15	+0.12	+0.06	-0.15	+0.08	-0.06	
	-	-	-	-	-	-	-	-
	+1.04	+0.84	+0.49	+1.13	+0.75	+0.99	+0.85	+1.10

First Moment Corrections

Load at C

Panel 1

$$6.77A - 0.20B = 0$$

$$-0.52A + 5.02B = 5.55$$

$$A = .33$$

$$B = 1.11$$

$$R_1 = \frac{2.91 \times .33 + 2.83 \times 1.11}{3.33} = 1.07$$

$$M_{AB} = 2\left(.33 + \frac{1.11}{2} - 1.07\right) = -.36$$

$$M_{BA} = 2\left(1.11 + \frac{.33}{2} - 1.07\right) = .40$$

Panel 2

$$5.34B - 0.63C = 5.16$$

$$-0.77B + 3.77C = -2.40$$

$$B = .91$$

$$C = -.45$$

$$R_2 = \frac{2.96 \times .91 - 2.91 \times .45}{3.91} = .35$$

$$M_{BC} = 2\left(.91 - \frac{.45}{2} - .35\right) = 1.02$$

$$M_{CB} = 2\left(-.45 + \frac{.91}{2} - .35\right) = -1.05$$

Panel 3

$$4.06C - 0.89D = 4.83$$

$$-1.02C + 2.53D = -1.88$$

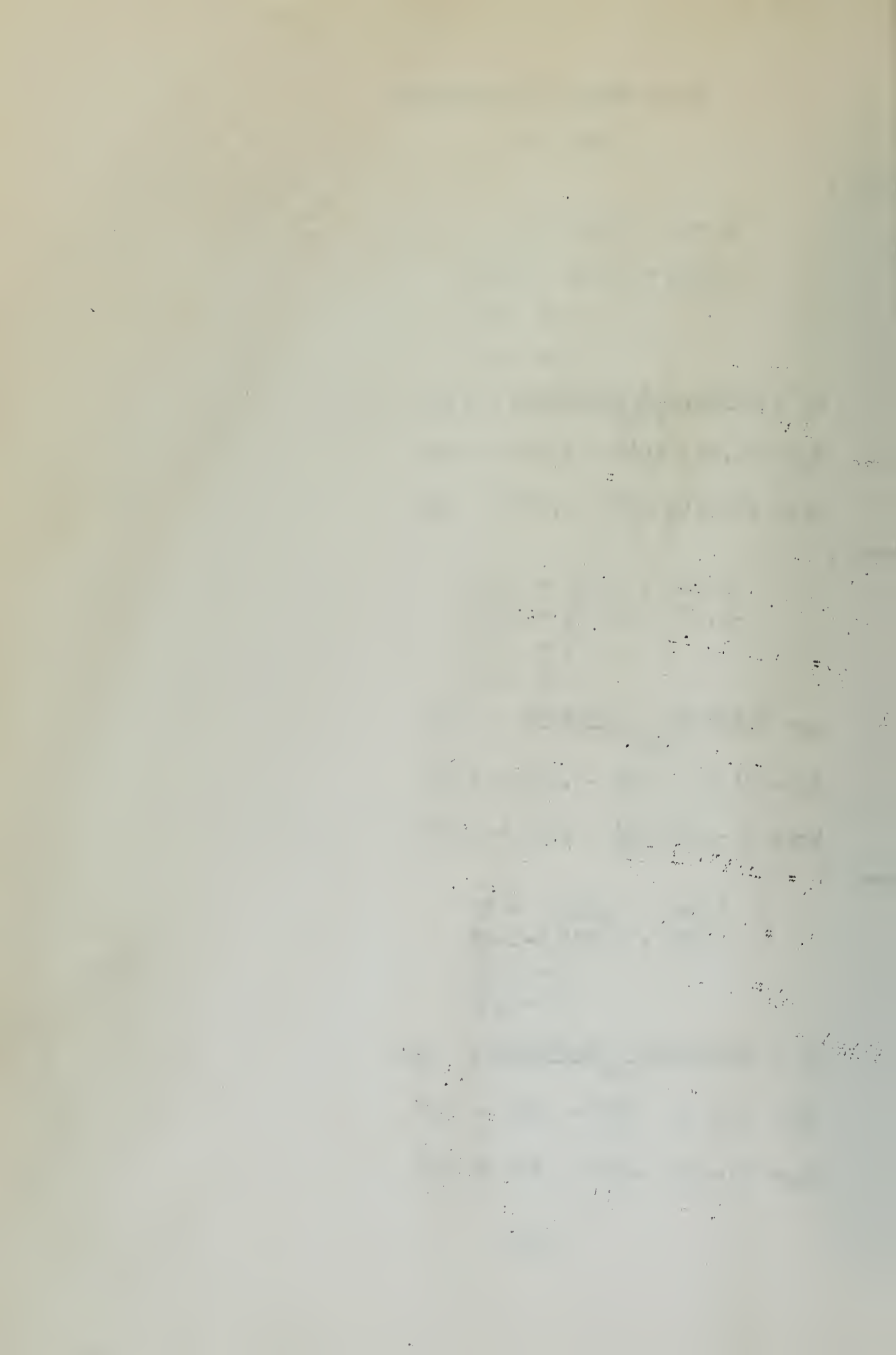
$$C = 1.13$$

$$D = -0.29$$

$$R_3 = \frac{2.95 \times 1.13 - 2.90 \times .29}{3.90} = .64$$

$$M_{CD} = 3\left(1.13 - \frac{.29}{2} - .64\right) = 1.08$$

$$M_{DC} = 3\left(-.29 + \frac{1.13}{2} - .64\right) = -1.08$$



Panel 4

$$\begin{aligned} 2.5D - E &= -2.32 \\ -D + 2.5E &= -1.88 \\ D &= -1.34 \\ E &= -1.46 \end{aligned}$$

$$R_4 = \frac{3}{4}(-1.34 - 1.46) = -2.10$$

$$M_{DE} = 4(-1.34 - \frac{1.46}{2} + 2.10) = .12$$

$$M_{ED} = 4(-1.46 - \frac{1.34}{2} + 2.10) = -.12$$

Panel 5

$$\begin{aligned} 2.5E - F &= -1.88 \\ -E + 2.5F &= -1.29 \\ E &= -1.14 \\ F &= -.97 \end{aligned}$$

$$R_5 = \frac{3}{4}(-1.14 - .97) = -1.58$$

$$M_{EF} = 4(-1.14 - \frac{.97}{2} + 1.58) = -.16$$

$$M_{FE} = 4(-.97 - \frac{1.14}{2} + 1.58) = .16$$

Panel 6

$$\begin{aligned} 2.53F - 1.02G &= -1.88 \\ -0.89F + 4.06G &= -1.62 \\ F &= -.99 \\ G &= -.62 \end{aligned}$$

$$R_6 = \frac{-2.95 \times .62 - 2.90 \times .60}{3.91} = -.77$$

$$M_{FG} = 3(-.99 - \frac{.62}{2} + .77) = -.40$$

$$M_{GF} = 3(-.62 - \frac{.99}{2} + .77) = .32$$

Panel 7

$$3.77G - 0.77H = -1.96$$

$$-0.63G + 5.34H = -1.85$$

$$G = -.60$$

$$H = -.42$$

$$R_7 = \frac{-2.91 \times .60 - 2.96 \times .42}{3.91} = -.77$$

$$M_{GH} = 2(-.60 - \frac{.42}{2} + .77) = -.12$$

$$M_{HG} = 2(-.42 - \frac{.60}{2} + .77) = .15$$

Panel 8

$$5.02H - 0.52I = -1.87$$

$$-0.20H + 6.72I = 0$$

$$H = -.37$$

$$I = -.01$$

$$R_8 = \frac{-2.83 \times .37 - 2.91 \times .01}{3.83} = -.28$$

$$M_{HI} = 2(-.37 - \frac{.01}{2} + .28) = -.18$$

$$M_{IH} = 2(-.01 - \frac{.37}{2} + .28) = .18$$

Second Moment Corrections - Load at C

Panel 1

$$\begin{aligned} 6.77A - 0.20B &= 0 \\ -0.52A + 5.02B &= -1.02 \\ A &= -.01 \\ B &= -.20 \end{aligned}$$

$$R_1 = \frac{-2.91 \times .01 - 2.83 \times .20}{3.83} = -.16$$

$$M_{AB} = 2(-.01 - \frac{.20}{2} + .16) = .10$$

$$M_{BA} = 2(-.20 - \frac{.01}{2} + .16) = -.10$$

Panel 2

$$\begin{aligned} 5.34B - 0.63C &= -.40 \\ -0.77B + 3.77C &= -1.08 \\ B &= -.11 \\ C &= -.28 \end{aligned}$$

$$R_2 = \frac{-2.96 \times .11 - 2.91 \times .28}{3.91} = -.30$$

$$M_{BC} = 2(-.11 - \frac{.28}{2} + .30) = .15$$

$$M_{CB} = 2(-.28 - \frac{.11}{2} + .30) = -.09$$

Panel 3

$$\begin{aligned} 4.06C - 0.89D &= 1.05 \\ -1.02C + 2.53D &= -.12 \\ C &= .27 \\ D &= .06 \end{aligned}$$

$$R_3 = \frac{2.95 \times .27 + 2.90 \times .06}{3.90} = .24$$

$$M_{CD} = 3(.27 + \frac{.06}{2} - .24) = .24$$

$$M_{DC} = 3(.06 + \frac{.27}{2} - .24) = -.16$$

Panel 4

$$2.5D - E = 1.08$$

$$-D + 2.5E = .16$$

$$D = .74$$

$$E = .36$$

$$R_5 = \frac{3}{4}(.74 + .36) = .82$$

$$M_{DE} = 4(.74 + \frac{.36}{2} - .82) = .40$$

$$M_{ED} = 4(.36 + \frac{.74}{2} - .82) = -.36$$

Panel 5

$$2.5E - F = .12$$

$$-E + 2.5F = .40$$

$$E = .13$$

$$F = .21$$

$$R_5 = \frac{3}{4}(.13 + .21) = .25$$

$$M_{EF} = 4(.13 + \frac{.21}{2} - .25) = -.08$$

$$M_{FE} = 4(.21 + \frac{.13}{2} - .25) = .08$$

Panel 6

$$2.53F - 1.02G = -.16$$

$$-0.89F + 4.06G = .12$$

$$F = -.06$$

$$G = .02$$

$$R_6 = \frac{-2.90 \times .06 + 2.95 \times .02}{3.90} = -.03$$

$$M_{FG} = 3(-.06 + \frac{.02}{2} + .03) = -.06$$

$$M_{GF} = 3(.02 - \frac{.06}{2} + .03) = .06$$

Panel 7

$$3.77G - 0.77H = -.32$$

$$-0.63G + 5.34H = .18$$

$$G = -.08$$

$$H = .02$$

$$R_7 = \frac{2.96 \times .02 - 2.91 \times .08}{3.91} = -.04$$

$$M_{GH} = 2(-.08 + \frac{.02}{2} + .04) = -.06$$

$$M_{HG} = 2(.02 - \frac{.08}{2} + .04) = .04$$

Panel 8

$$5.02H - 0.52I = -.15$$

$$-0.20H + 6.77I = 0$$

$$H = -.03$$

$$I = 0$$

$$R_8 = \frac{-2.83 \times .03}{3.83} = -.02$$

$$M_{HI} = 2(-.03 + .02) = -.02$$

$$M_{IH} = 2(\frac{-.03}{2} + .02) = .02$$

Load at PP2

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
-Q	4.56	5.38	4.98	5.23	-2.33	-2.38	-1.87	-1.87
×	0.71	1.14	1.14	1.62	-0.72	-0.76	-1.25	-1.25
R	4.07		3.80		-1.70		-2.34	
M'	-5.58	-5.16	-5.55	-4.83	2.40	2.32	1.88	1.88
-Q	0.00	5.55	5.16	-2.40	4.83	-1.88	-2.32	-1.88
×	0.33	1.11	0.91	-0.45	1.13	-0.29	-1.34	-1.46
R	1.07		0.35		0.64		-2.10	
M''	-0.36	0.40	1.02	-1.05	1.08	-1.08	0.12	-0.12
-Q	0.00	-1.02	-0.40	-1.08	1.05	-0.12	1.08	0.16
×	-0.01	-0.20	-0.11	-0.28	0.27	0.06	0.74	0.36
R	-0.16		-0.30		0.24		0.82	
M'''	0.10	-0.10	0.15	-0.09	0.24	-0.16	0.40	-0.36
M	-5.84	-4.81	-4.38	-5.97	3.72	1.08	2.40	1.40

1. The first part of the paper is devoted to a general discussion of the problem of the existence of solutions of the system of equations

(1)
$$\frac{dx}{dt} = f(x, y, z), \quad \frac{dy}{dt} = g(x, y, z), \quad \frac{dz}{dt} = h(x, y, z)$$

where f, g, h are continuous functions of x, y, z and satisfy the Lipschitz condition.

2. In the second part we consider the case when the functions f, g, h are linear in x, y, z .

3. In the third part we consider the case when the functions f, g, h are quadratic in x, y, z .

4. In the fourth part we consider the case when the functions f, g, h are cubic in x, y, z .

5. In the fifth part we consider the case when the functions f, g, h are of higher order in x, y, z .

6. In the sixth part we consider the case when the functions f, g, h are of arbitrary order in x, y, z .

7. In the seventh part we consider the case when the functions f, g, h are of arbitrary order in x, y, z .

8. In the eighth part we consider the case when the functions f, g, h are of arbitrary order in x, y, z .

5		6		7		8	
E	F	F	G	G	H	H	I
-1.87	-1.87	-1.64	-1.60	-1.75	-1.67	-1.79	-1.45
-1.25	-1.25	-0.94	-0.60	-0.54	-0.37	-0.41	-0.23
-2.34		-1.56		-1.27		-1.45	
1.88	1.88	1.29	1.96	1.62	1.87	1.85	2.04
-1.88	-1.29	-1.88	-1.62	-1.96	-1.85	-1.87	0.00
-1.14	-0.97	-0.99	-0.62	-0.60	-0.42	-0.37	-0.01
-1.58		-1.20		-0.77		-0.28	
-0.16	0.16	-0.40	0.32	-0.12	0.15	-0.18	0.18
0.12	0.40	-0.16	0.12	-0.32	0.18	-0.15	0.00
0.13	0.21	-0.06	0.02	-0.08	0.02	-0.03	0.00
0.25		-0.03		-0.04		-0.02	
-0.08	0.08	-0.06	0.06	-0.06	0.04	-0.02	0.02
1.64	2.12	0.83	2.34	1.38	2.06	1.65	2.24

Influence Lines - First Correction

Load at Panel Pt 3 (= D)

Panel 1

$$6.77A - .2B = 0$$

$$A = .03$$

$$-.52A + 5.02B = 4.71$$

$$R_1 = \frac{(3 - .0866).03 + (3 - .1732).94}{2(2 - .0866)} = .72$$

$$M_{AB} = 2(.03 + \frac{.94}{2} - .72) = -.44$$

$$M_{BA} = 2(.94 + \frac{.03}{2} - .72) = .46$$

Panel 2

$$5.34B - .62C = 4.30$$

$$B = .98$$

$$-.76B + 3.77C = 4.84$$

$$C = 1.48$$

$$R_2 = \frac{(3 - .0443).98 + (3 - .0886)1.48}{2(2 - .0443)} = 1.84$$

$$M_{BC} = 3(.98 + \frac{1.48}{2} - 1.84) = -.36$$

$$M_{CB} = 3(1.48 + \frac{.98}{2} - 1.84) = .39$$

Panel 3

$$4.05C - .9D = 4.11$$

$$C = .84$$

$$-1.02C + 2.53D = -2.84$$

$$D = -.78$$

$$R_3 = \frac{(3 - .0482).84 + (3 - .0964)(-.78)}{2(2 - .0482)} = .06$$

$$M_{CD} = 4(.84 - \frac{.78}{2} - .06) = 1.56$$

$$M_{DC} = 4(-.78 + \frac{.84}{2} - .06) = -1.68$$

CONTENTS
ORIGINAL ARTICLES
The Effect of the Diet on the Blood Pressure in Normal and Hypertensive Persons
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Panel 4

$$2.5D - 1E = 3.36$$

$$-1D + 2.5E = -2.81$$

$$D = 1.07$$

$$E = -.70$$

$$R = \frac{3}{4}(1.07 - .70) = .28$$

$$M_{DE} = 4(1.07 - \frac{.70}{2} - .28) = 1.76$$

$$M_{ED} = 4(-.70 + \frac{1.07}{2} - .28) = -1.80$$

Panel 5

$$2.5F - 1E = -2.84$$

$$-1F + 2.5E = -1.93$$

$$E = -1.46$$

$$F = -1.72$$

$$R = \frac{3}{4}(-1.46 - 1.72) = -2.38$$

$$M_{FE} = 4(-1.72 - \frac{1.46}{2} + 2.38) = -.28$$

$$M_{EF} = 4(-1.46 - \frac{1.72}{2} + 2.38) = .24$$

Panel 6

$$4.05G - 0.9F = -2.43$$

$$-1.02G + 2.53F = -2.81$$

$$G = -.93$$

$$F = -1.48$$

$$R = \frac{-(3 - .0482) \cdot .93 - (3 - .0964)1.48}{2(2 - .0482)} = -1.80$$

$$M_{FG} = 4(-1.48 - \frac{.93}{2} + 1.80) = -.56$$

$$M_{GF} = 4(-.93 - \frac{1.48}{2} + 1.80) = .52$$

1. The first part of the paper is devoted to a general discussion of the problem of the existence of solutions of the system of equations (1) for arbitrary values of the parameters $\alpha, \beta, \gamma, \delta, \epsilon, \zeta, \eta, \theta, \iota, \kappa, \lambda, \mu, \nu, \xi, \omicron, \pi, \rho, \sigma, \tau, \upsilon, \phi, \chi, \psi, \omega, \varphi, \eta, \theta, \iota, \kappa, \lambda, \mu, \nu, \xi, \omicron, \pi, \rho, \sigma, \tau, \upsilon, \phi, \chi, \psi, \omega, \varphi$.

2. In the second part of the paper, we consider the case of the existence of solutions of the system of equations (1) for arbitrary values of the parameters $\alpha, \beta, \gamma, \delta, \epsilon, \zeta, \eta, \theta, \iota, \kappa, \lambda, \mu, \nu, \xi, \omicron, \pi, \rho, \sigma, \tau, \upsilon, \phi, \chi, \psi, \omega, \varphi$.

3. In the third part of the paper, we consider the case of the existence of solutions of the system of equations (1) for arbitrary values of the parameters $\alpha, \beta, \gamma, \delta, \epsilon, \zeta, \eta, \theta, \iota, \kappa, \lambda, \mu, \nu, \xi, \omicron, \pi, \rho, \sigma, \tau, \upsilon, \phi, \chi, \psi, \omega, \varphi$.

4. In the fourth part of the paper, we consider the case of the existence of solutions of the system of equations (1) for arbitrary values of the parameters $\alpha, \beta, \gamma, \delta, \epsilon, \zeta, \eta, \theta, \iota, \kappa, \lambda, \mu, \nu, \xi, \omicron, \pi, \rho, \sigma, \tau, \upsilon, \phi, \chi, \psi, \omega, \varphi$.

Panel 7

$$5.34 \text{ H} - .62 \text{ G} = -2.78$$

$$-.76 \text{ H} + 3.77 \text{ G} = -2.94$$

$$\text{G} = -.91$$

$$\text{H} = -.63$$

$$\text{R} = - \frac{(3-.0443) \cdot .63 - (3-.0886) \cdot .91}{2(2-.0443)} = -1.15$$

$$\text{M}_{\text{GH}} = 3 \left(-.91 - \frac{.63}{2} + 1.15 \right) = -.21$$

$$\text{M}_{\text{HG}} = 3 \left(-.63 - \frac{.91}{2} + 1.15 \right) = .21$$

Panel 8

$$6.77 \text{ I} - .2 \text{ H} = 0$$

$$-.52 \text{ I} + 5.02 \text{ H} = -2.80$$

$$\text{H} = -.56$$

$$\text{I} = -.02$$

$$\text{R} = - \frac{(3-.0866) \cdot .02 - (3-.1732) \cdot .56}{2(2-.0866)} = -.43$$

$$\text{M}_{\text{HI}} = 2 \left(-.56 - \frac{.02}{2} + .43 \right) = -.28$$

$$\text{M}_{\text{IH}} = 2 \left(-.02 - \frac{.56}{2} + .43 \right) = .26$$

Influence Lines - Second Correction

Load @ PP3 = D

Panel 1

$$6.77 A - .2 B = 0$$

$$-.52 A + 5.02 B = +.44$$

$$A = .003$$

$$B = .090$$

$$R_1 = \frac{(3 - .0866) \cdot 0.003 + (3 - 1.732) \cdot .09}{2(2 - .0866)} = .094$$

$$M_{AB} = 2(.003 + \frac{.090}{2} - .094) = -.09$$

$$M_{BA} = 2(.090 + .003 - .094) = -.01$$

Panel 2

$$5.34 B - .62 C = -.46$$

$$-.76 B + 3.77 C = 1.56$$

$$B = -.04$$

$$C = .41$$

$$R_2 = \frac{(3 - .0443) \cdot -.04 + (3 - .0886)(+.41)}{2(2 - .0443)} = .28$$

$$M_{BC} = 3(-.04 + \frac{.41}{2} - .28) = -.36$$

$$M_{CB} = 3(+.41 - \frac{.04}{2} - .28) = .33$$

Panel 3

$$4.05 C - 0.9 D = -.39$$

$$-1.02 C + 2.53 D = -1.76$$

$$C = -.27$$

$$D = -.81$$

$$R_3 = \frac{(3 - .0482)(-.27) + (3 - .0964)(-.81)}{2(2 - .0482)} = -.80$$

$$M_{CD} = 4(-.27 - \frac{.81}{2} + .80) = .52$$

$$M_{DC} = 4(-.81 - \frac{.27}{2} + .80) = -.44$$

CHICAGO, ILL., MAY 1, 1919

TO THE EDITOR:

I have the honor to acknowledge the receipt of your letter of April 25, 1919, in relation to the matter of the American Medical Association's position on the subject of the proposed amendment to the constitution of the United States, which would give the Federal Government the right to regulate the practice of medicine.

The American Medical Association is opposed to the proposed amendment, and believes that the regulation of the practice of medicine should be left to the States.

I am, Sir, very respectfully,
Yours truly,
J. H. H. H.

Very truly yours,
J. H. H. H.

Very truly yours,
J. H. H. H.

W. H. H.

Very truly yours,
J. H. H. H.

Very truly yours,
J. H. H. H.

W. H. H.

Very truly yours,
J. H. H. H.

Very truly yours,
J. H. H. H.

Very truly yours,
J. H. H. H.

W. H. H.

Panel 4

$$2.5 D - 1E = 1.68$$

$$-1.0 D + 2.5 E = -.24$$

$$D = .75$$

$$E = .21$$

$$R_4 = \frac{3}{4} (.75 + .21) = .72$$

$$M_{DE} = 4(.75 + \frac{.21}{2} - .72) = .52$$

$$M_{ED} = 4(.21 + \frac{.75}{2} - .72) = -.56$$

Panel 5

$$-1 F + 2.5 E = 1.80$$

$$2.5 F + 1.0 E = 1.56$$

$$E = .96$$

$$F = .61$$

$$R_5 = \frac{3}{4} (.96 + .61) = 1.18$$

$$M_{EF} = 4(.96 + \frac{.61}{2} - 1.18) = .32$$

$$M_{FE} = 4(.61 + \frac{.96}{2} - 1.18) = -.40$$

Panel 6

$$-1.02 G + 2.53 F = .28$$

$$4.05 G - 0.9 F = .21$$

$$G = .08$$

$$F = .14$$

$$R_6 = \frac{(3-.0482).08 + (3-.0964).14}{2(2-.0482)} = .16$$

$$M_{FG} = 4(.14 + \frac{.08}{2} - .16) = .08$$

$$M_{GF} = 4(.08 + \frac{.14}{2} - .16) = -.04$$

Panel 7

$$-.76 H + 3.77 G = -.52$$

$$5.34 H - .62 G = .28$$

$$H = .04$$

$$G = -.13$$

$$R_7 = \frac{(3-.0443).04 - (3-.0886).13}{2(2-.0443)} = -.07$$

$$M_{GH} = 3(-.13 + \frac{.04}{2} + .07) = -.12$$

$$M_{HG} = 3(.04 - \frac{.13}{2} + .07) = .15$$

Panel 8

$$-.52 I + 5.02 H = -.21$$

$$6.77 I - 0.20 H = 0$$

$$I = 0$$

$$H = -.04$$

$$R_8 = -\frac{(3-.1732).04}{2(2-.0866)} = -.03$$

$$M_{HI} = 2(-.04 + .03) = -.02$$

$$M_{IH} = 2(-\frac{.04}{2} + .03) = .02$$

Load At PP3 = D

Panel Point	1		2		3		4	
	A	B	B	C	C	D	D	E
Q	3.81	4.49	4.16	4.36	4.02	4.12	-2.81	-2.81
q	.59	.96	.94	1.34	1.49	2.23	-1.87	-1.87
R	3.40		3.18		3.81		-3.51	
M'	-4.66	-4.30	-4.71	-4.11	-4.84	-3.36	2.84	2.84
-Q	0	4.71	4.30	4.84	4.11	-2.82	3.36	-2.81
q	.03	.94	.98	1.48	.84	-.78	1.07	-.70
R	.72		1.84		.06		.28	
M''	-.44	.46	-.36	.39	1.56	-1.68	1.76	-1.80
-Q	0	.44	-.46	1.56	-.39	-1.76	1.68	-.24
q	.003	.090	-.04	.41	-.27	-.81	.75	.21
R	.094		.28		-.80		.72	
M'''	-.09	-.01	-.36	.33	.52	-.44	.52	-.56
Σ M	-5.19	-3.85	-5.43	-3.39	-2.76	-5.48	5.12	.48

Table of Contents

Page

Chapter I	1
Chapter II	15
Chapter III	30
Chapter IV	45
Chapter V	60
Chapter VI	75
Chapter VII	90
Chapter VIII	105
Chapter IX	120
Chapter X	135
Chapter XI	150
Chapter XII	165
Chapter XIII	180
Chapter XIV	195
Chapter XV	210
Chapter XVI	225
Chapter XVII	240
Chapter XVIII	255
Chapter XIX	270
Chapter XX	285
Chapter XXI	300
Chapter XXII	315
Chapter XXIII	330
Chapter XXIV	345
Chapter XXV	360
Chapter XXVI	375
Chapter XXVII	390
Chapter XXVIII	405
Chapter XXIX	420
Chapter XXX	435
Chapter XXXI	450
Chapter XXXII	465
Chapter XXXIII	480
Chapter XXXIV	495
Chapter XXXV	510
Chapter XXXVI	525
Chapter XXXVII	540
Chapter XXXVIII	555
Chapter XXXIX	570
Chapter XL	585
Chapter XLI	600
Chapter XLII	615
Chapter XLIII	630
Chapter XLIV	645
Chapter XLV	660
Chapter XLVI	675
Chapter XLVII	690
Chapter XLVIII	705
Chapter XLIX	720
Chapter L	735
Chapter LI	750
Chapter LII	765
Chapter LIII	780
Chapter LIV	795
Chapter LV	810
Chapter LVI	825
Chapter LVII	840
Chapter LVIII	855
Chapter LIX	870
Chapter LX	885
Chapter LXI	900
Chapter LXII	915
Chapter LXIII	930
Chapter LXIV	945
Chapter LXV	960
Chapter LXVI	975
Chapter LXVII	990
Chapter LXVIII	1005
Chapter LXIX	1020
Chapter LXX	1035
Chapter LXXI	1050
Chapter LXXII	1065
Chapter LXXIII	1080
Chapter LXXIV	1095
Chapter LXXV	1110
Chapter LXXVI	1125
Chapter LXXVII	1140
Chapter LXXVIII	1155
Chapter LXXIX	1170
Chapter LXXX	1185
Chapter LXXXI	1200
Chapter LXXXII	1215
Chapter LXXXIII	1230
Chapter LXXXIV	1245
Chapter LXXXV	1260
Chapter LXXXVI	1275
Chapter LXXXVII	1290
Chapter LXXXVIII	1305
Chapter LXXXIX	1320
Chapter LXXXX	1335
Chapter LXXXXI	1350
Chapter LXXXXII	1365
Chapter LXXXXIII	1380
Chapter LXXXXIV	1395
Chapter LXXXXV	1410
Chapter LXXXXVI	1425
Chapter LXXXXVII	1440
Chapter LXXXXVIII	1455
Chapter LXXXXIX	1470
Chapter LXXXXX	1485
Chapter LXXXXXI	1500
Chapter LXXXXXII	1515
Chapter LXXXXXIII	1530
Chapter LXXXXXIV	1545
Chapter LXXXXXV	1560
Chapter LXXXXXVI	1575
Chapter LXXXXXVII	1590
Chapter LXXXXXVIII	1605
Chapter LXXXXXIX	1620
Chapter LXXXXXX	1635
Chapter LXXXXXXI	1650
Chapter LXXXXXXII	1665
Chapter LXXXXXXIII	1680
Chapter LXXXXXXIV	1695
Chapter LXXXXXXV	1710
Chapter LXXXXXXVI	1725
Chapter LXXXXXXVII	1740
Chapter LXXXXXXVIII	1755
Chapter LXXXXXXIX	1770
Chapter LXXXXXXX	1785
Chapter LXXXXXXXI	1800
Chapter LXXXXXXXII	1815
Chapter LXXXXXXXIII	1830
Chapter LXXXXXXXIV	1845
Chapter LXXXXXXXV	1860
Chapter LXXXXXXXVI	1875
Chapter LXXXXXXXVII	1890
Chapter LXXXXXXXVIII	1905
Chapter LXXXXXXXIX	1920
Chapter LXXXXXXXI	1935
Chapter LXXXXXXXII	1950
Chapter LXXXXXXXIII	1965
Chapter LXXXXXXXIV	1980
Chapter LXXXXXXXV	1995

cont.)

Panel Point	5		6		7		8	
	E	F	F	G	G	H	H	I
-Q	-2.81	-2.81	-2.47	-2.40	-2.62	-2.50	-2.67	-2.18
q	-1.87	-1.87	-1.41	-0.90	-0.81	-0.56	-0.62	-0.34
R	-3.52		-2.34		-1.90		-2.18	
M'	2.81	2.81	1.93	2.94	2.43	2.80	2.78	3.06
-Q	-1.93	-2.84	-2.43	-2.81	-2.78	-2.94	-2.80	0
q	-1.46	-1.72	-1.48	-.93	-.91	-.63	-.56	-.02
R	-2.38		-1.80		-1.15		-.43	
M''	.24	-.28	-.56	.52	-.21	.21	-.28	.26
-Q	1.80	.56	.28	.21	.52	.28	-.21	0
q	.61	.96	.14	.08	-.13	.04	-.04	0
M'''	1.18		.16		-.07		-.03	
ΣM	3.37	2.13	1.45	3.32	2.10	3.16	2.48	3.34

Influence Lines - First Corrections
Load at E

Panels 1 & 8

$$6.77A - 0.20B = 0 \quad A = .02$$

$$-0.52A + 5.02B = 3.72 \quad B = .72$$

$$R_1 = \frac{2.914 \times .02 + 2.828 \times .72}{3.828} = .55$$

$$M_{AB} = 2\left(.02 + \frac{.72}{2} - .55\right) = -.34$$

$$M_{BA} = 2\left(.72 + \frac{.02}{2} - .55\right) = .36$$

Panels 2 & 7

$$5.34B - 0.63C = 3.60 \quad B = .81$$

$$-0.77B + 3.77C = 3.84 \quad C = 1.18$$

$$R_2 = \frac{2.96 \times .81 + 2.91 \times 1.18}{3.912} = 1.49$$

$$M_{BC} = 3\left(.81 + \frac{1.18}{2} - 1.49\right) = -.27$$

$$M_{CB} = 3\left(1.18 + \frac{.81}{2} - 1.49\right) = .27$$

Panels 3 & 6

$$4.06C - 0.89D = 3.24 \quad C = 1.23$$

$$-1.02C + 2.53D = 3.76 \quad D = 1.99$$

$$R_3 = \frac{2.95 \times 1.23 + 2.90 \times 1.99}{3.904} = 2.40$$

$$M_{CD} = 4\left(1.23 + \frac{1.99}{2} - 2.40\right) = -.72$$

$$M_{DC} = 4\left(1.99 + \frac{1.23}{2} - 2.40\right) = .80$$

Panels 4 & 5

$$2.5E - 1.0D = 2.68$$

$$-1.0E + 2.5D = -3.75$$

$$R_4 = \frac{3}{4}(-1.28 + .56) = -.54$$

$$M_{DE} = 4\left(-1.28 + \frac{.56}{2} + .54\right) = -1.84$$

$$M_{ED} = 4\left(.56 - \frac{1.28}{2} + .54\right) = 1.84$$

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Influence Lines - Second Correction

Load at E

Panels 1 & 8

$$6.77A - 0.20B = 0$$

$$A = 0$$

$$-0.52A + 5.02B = .27$$

$$B = .05$$

$$R_4 = .04$$

$$R_1 = \frac{2.914 \times 0 + 2.828 \times .05}{3.828}$$

$$M_{AB} = 2 \left(0 + \frac{.05}{2} - .04 \right) = -.04$$

$$M_{BA} = 2 \left(.05 + \frac{0}{2} - .04 \right) = .02$$

Panels 2 & 7

$$5.34B - 0.63C = -.36$$

$$B = -.05$$

$$-0.77B + 3.77C = .72$$

$$C = .18$$

$$R_2 = \frac{-2.96 \times .05 + 2.91 \times .18}{3.912}$$

$$R_4 = .10$$

$$M_{BC} = 3 \left(-.05 + \frac{.18}{2} - .10 \right) = -.18$$

$$M_{CB} = 3 \left(.18 - \frac{.05}{2} - .10 \right) = .18$$

Panels 3 & 6

$$4.06C - 0.89D = -.27$$

$$C = -.24$$

$$-1.02C + 2.53D = 1.84$$

$$D = -.86$$

$$R_3 = \frac{2.95(-.25) + 2.90(-.82)}{3.904}$$

$$R_3 = -.80$$

$$M_{CD} = 4 \left(-.25 - \frac{.82}{2} + .80 \right) = .56$$

$$M_{DC} = 4 \left(-.82 - \frac{.25}{2} + .80 \right) = -.56$$

Panels 4 & 5

$$2.5E - 1.0D = -.80$$

$$D = -.02$$

$$-1.0E + 2.5D = 1.84$$

$$E = .73$$

$$R_4 = \frac{3}{4}(-.02 + .73)$$

$$R_4 = .53$$

$$M_{DE} = 4 \left(-.02 + \frac{.73}{2} + .53 \right) = -.76$$

$$M_{ED} = 4 \left(.73 - \frac{.02}{2} - .53 \right) = .76$$

1. 5. 1.
2. 5. 2.
3. 5. 3.

1. 5. 1. - 1. 5. 1.
2. 5. 2. - 1. 5. 2.

1. 5. 1.
2. 5. 2.
3. 5. 3.

1. 5. 1.
2. 5. 2.
3. 5. 3.

1. 5. 1. - 1. 5. 1.
2. 5. 2. - 1. 5. 2.

Load at Panel Pt 4 = E

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
-Q	3.04	3.59	3.32	3.49	3.21	3.30	3.75	3.75
α	.47	.76	.75	1.08	1.19	1.78	2.50	2.50
R	2.79		2.53		3.04		4.69	
M'	-3.88	-3.60	-3.72	-3.24	-3.84	-2.68	-3.76	-3.76
-Q	0	3.72	3.60	3.84	3.24	3.76	2.68	-3.75
α	.02	.72	.81	1.18	1.23	1.99	-1.28	.56
R	.55		1.49		2.40		- .54	
M''	- .34	.36	- .27	.27	- .72	.80	1.84	-1.84
-Q	0	.27	- .36	.72	- .27	-1.84	- .80	1.84
α	0	.05	- .05	.18	- .25	- .82	- .02	.73
R	.04		.10		- .80		.53	
M'	- .04	.02	- .18	.18	.56	- .56	- .76	.76
M'''	-4.26	-3.32	-4.17	-2.79	-4.00	-2.44	-2.68	-4.84

ORIGINAL ARTICLES		DEPARTMENTS		BOOK REVIEWS	
1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48
49	50	51	52	53	54
55	56	57	58	59	60
61	62	63	64	65	66
67	68	69	70	71	72
73	74	75	76	77	78
79	80	81	82	83	84
85	86	87	88	89	90
91	92	93	94	95	96
97	98	99	100	101	102
103	104	105	106	107	108
109	110	111	112	113	114
115	116	117	118	119	120
121	122	123	124	125	126
127	128	129	130	131	132
133	134	135	136	137	138
139	140	141	142	143	144
145	146	147	148	149	150
151	152	153	154	155	156
157	158	159	160	161	162
163	164	165	166	167	168
169	170	171	172	173	174
175	176	177	178	179	180
181	182	183	184	185	186
187	188	189	190	191	192
193	194	195	196	197	198
199	200	201	202	203	204
205	206	207	208	209	210
211	212	213	214	215	216
217	218	219	220	221	222
223	224	225	226	227	228
229	230	231	232	233	234
235	236	237	238	239	240
241	242	243	244	245	246
247	248	249	250	251	252
253	254	255	256	257	258
259	260	261	262	263	264
265	266	267	268	269	270
271	272	273	274	275	276
277	278	279	280	281	282
283	284	285	286	287	288
289	290	291	292	293	294
295	296	297	298	299	300
301	302	303	304	305	306
307	308	309	310	311	312
313	314	315	316	317	318
319	320	321	322	323	324
325	326	327	328	329	330
331	332	333	334	335	336
337	338	339	340	341	342
343	344	345	346	347	348
349	350	351	352	353	354
355	356	357	358	359	360
361	362	363	364	365	366
367	368	369	370	371	372
373	374	375	376	377	378
379	380	381	382	383	384
385	386	387	388	389	390
391	392	393	394	395	396
397	398	399	400	401	402
403	404	405	406	407	408
409	410	411	412	413	414
415	416	417	418	419	420
421	422	423	424	425	426
427	428	429	430	431	432
433	434	435	436	437	438
439	440	441	442	443	444
445	446	447	448	449	450
451	452	453	454	455	456
457	458	459	460	461	462
463	464	465	466	467	468
469	470	471	472	473	474
475	476	477	478	479	480
481	482	483	484	485	486
487	488	489	490	491	492
493	494	495	496	497	498
499	500	501	502	503	504
505	506	507	508	509	510
511	512	513	514	515	516
517	518	519	520	521	522
523	524	525	526	527	528
529	530	531	532	533	534
535	536	537	538	539	540
541	542	543	544	545	546
547	548	549	550	551	552
553	554	555	556	557	558
559	560	561	562	563	564
565	566	567	568	569	570
571	572	573	574	575	576
577	578	579	580	581	582
583	584	585	586	587	588
589	590	591	592	593	594
595	596	597	598	599	600
601	602	603	604	605	606
607	608	609	610	611	612
613	614	615	616	617	618
619	620	621	622	623	624
625	626	627	628	629	630
631	632	633	634	635	636
637	638	639	640	641	642
643	644	645	646	647	648
649	650	651	652	653	654
655	656	657	658	659	660
661	662	663	664	665	666
667	668	669	670	671	672
673	674	675	676	677	678
679	680	681	682	683	684
685	686	687	688	689	690
691	692	693	694	695	696
697	698	699	700	701	702
703	704	705	706	707	708
709	710	711	712	713	714
715	716	717	718	719	720
721	722	723	724	725	726
727	728	729	730	731	732
733	734	735	736	737	738
739	740	741	742	743	744
745	746	747	748	749	750
751	752	753	754	755	756
757	758	759	760	761	762
763	764	765	766	767	768
769	770	771	772	773	774
775	776	777	778	779	780
781	782	783	784	785	786
787	788	789	790	791	792
793	794	795	796	797	798
799	800	801	802	803	804
805	806	807	808	809	810
811	812	813	814	815	816
817	818	819	820	821	822
823	824	825	826	827	828
829	830	831	832	833	834
835	836	837	838	839	840
841	842	843	844	845	846
847	848	849	850	851	852
853	854	855	856	857	858
859	860	861	862	863	864
865	866	867	868	869	870
871	872	873	874	875	876
877	878	879	880	881	882
883	884	885	886	887	888
889	890	891	892	893	894
895	896	897	898	899	900
901	902	903	904	905	906
907	908	909	910	911	912
913	914	915	916	917	918
919	920	921	922	923	924
925	926	927	928	929	930
931	932	933	934	935	936
937	938	939	940	941	942
943	944	945	946	947	948
949	950	951	952	953	954
955	956	957	958	959	960
961	962	963	964	965	966
967	968	969	970	971	972
973	974	975	976	977	978
979	980	981	982	983	984
985	986	987	988	989	990
991	992	993	994	995	996
997	998	999	1000	1001	1002

Panel	5		6		7		8	
Joint	E	F	F	G	G	H	H	I
-Q	-3.75	-3.75	-3.29	-3.20	-3.50	-3.33	-3.58	-2.91
α	-2.50	-2.50	-1.87	-1.20	-1.08	-0.75	-0.83	-0.45
R	-4.69		-3.12		-2.53		-2.91	
M	3.75	3.75	2.58	3.92	3.24	3.73	3.60	4.08
-Q	3.76	-2.58	-3.75	-3.24	-3.92	-3.60	-3.72	0
α	1.30	- .51	-1.98	-1.23	-1.20	- .81	- .72	- .02
R	.59		-2.40		-1.51		- .55	
M'	1.84	1.80	- .76	.72	- .27	.30	- .36	.34
-Q	-1.84	.76	1.80	.27	- .72	.36	- .30	0
α	- .73	.02	.82	.25	- .18	.05	- .05	0
R	- .53		.80		- .10		- .04	
M''	- .76	.76	.56	- .56	- .18	.18	- .02	.04
M'''	4.83	2.71	2.38	4.08	2.79	4.18	3.22	4.26

Preliminary Moment Computations - Web Members

Member AA'

Moment Dh	=	3144	fk
hh E-60	=	2865	
Impact	=	<u>615</u>	
Total		3480	
hh H-15-S-12 44	=	368	
Conc	=	86	
Impact	=	<u>50</u>	
Total		504	
Sidewalk hh	=	220	
Design Moment	=	7362	fk

Member BB'

Dh	=	5170	
hh E-60	=	4410	
Impact	=	<u>950</u>	
Total		5360	
hh H15-S-12 44	=	605	
Conc.	=	125	
Impact	=	<u>83</u>	
Total		813	
Sidewalk hh	=	362	
Design Moment	=	11,745	fk

Member CC'

Dh	=	3000	
hh E-60	=	2630	
Impact	=	<u>830</u>	
Total		3460	
hh H15-S-12-44	=	350	
Conc.	=	92	
Impact	=	<u>67</u>	
Total		509	
Sidewalk hh	=	256	
Design Moment	=	7243	fk

Member DD'

DL = 1600

LL E-60 = 1480

Impact = 520

Total 2000

LL H15-S12-44 = 182

Conc. = 69

Impact = 37

Total 288

Sidewalk = 144

Design Moment = 4046 fk

Member EE'

DL = 945

LL E-60 = 910

Impact = 441

Total 1351

LL H15-S12-44 = 110

Conc. = 52

Impact = 26

Total 188

Sidewalk = 97

Design Moment = 2593 fk

Preliminary Moment Computations - Chord Members

Member AB

DL = 3440

LL E-60 = 3020

Impact = 695

Total 3715

LL H15-S12-44 = 403

Conc. = 87

Impact = 73

Total 563

Sidewalk hh = 240

Design Moment = 7958 fk

Member BC

DL = 2260

LL E-60 = 2040

Impact = 520

Total 2560

LL H15-S12-44 = 264

Conc. = 50

Impact = 52

Total 366

Sidewalk hh = 173

Design Moment = 5360 fk

Member CD

DL = 1432

LL E-60 = 1330

Impact = 383

Total 1713

LL H15-S12-44 = 168

Conc. = 73

Impact = 44

Total 285

Sidewalk = 118

Design Moment = 3548 fk

Member DE

DL = 1480

LL E-60 = 1200

Impact = 490

Total 1890

LL H15-S12-44 = 173

Conc. = 66

Impact = 49

Total 288

Sidewalk = 133

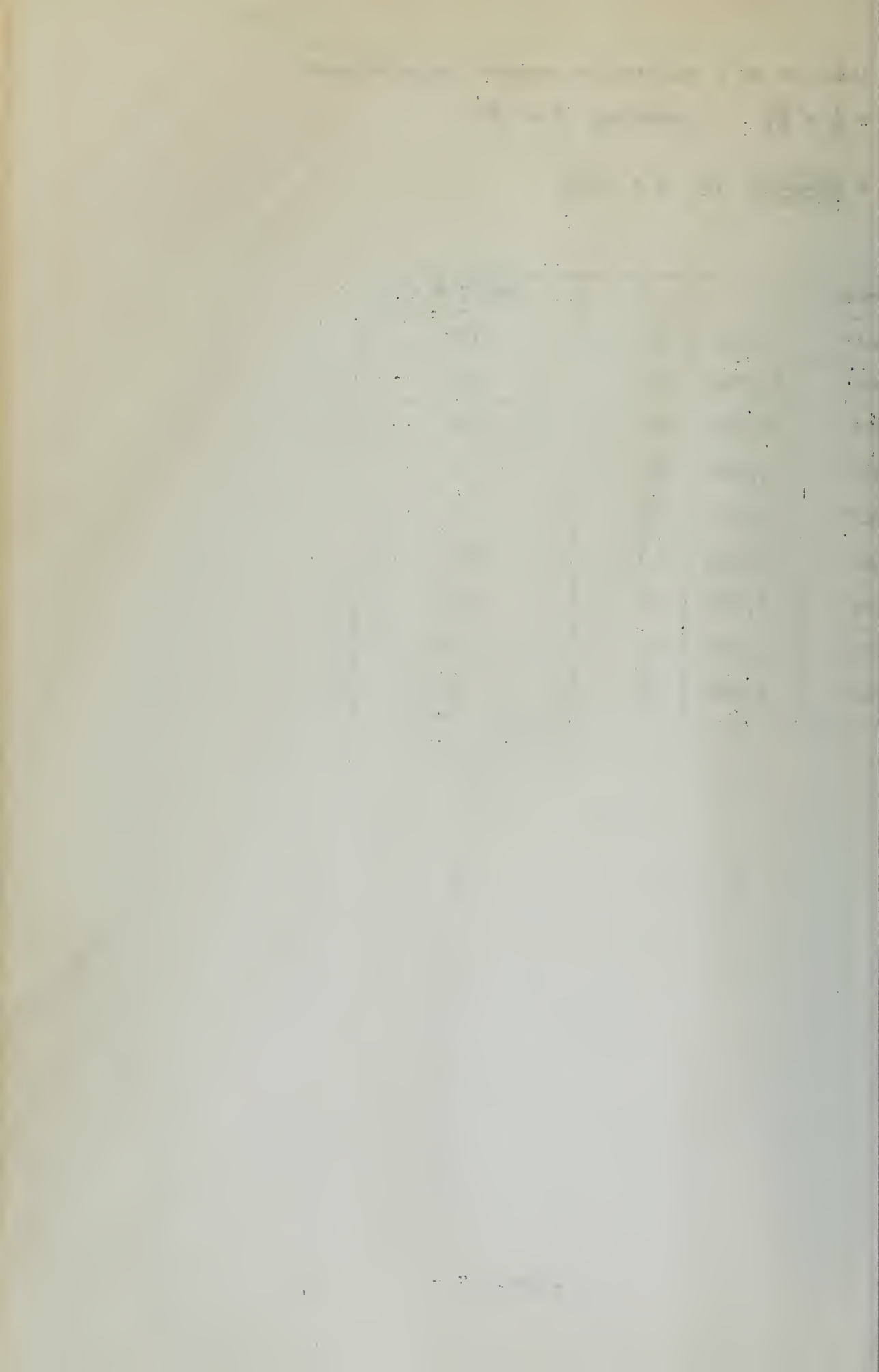
Design Moment = 3790 fk

Determination of K values for second computations

$K = \frac{I}{L} = \frac{Mc}{fL}$ Assuming $C = 15''$

$K = \frac{N \times 15 \times 12}{20 \times L \times 12}$ or $K = .75 \frac{M}{L}$

Member	M	L	.75M/L = K
AA'	7362	35	160
BB'	11,745	38	232
CC'	7,243	40	136
DD'	4,064	41	74
EE'	2,593	41	47
AB	7,958	30	200
BC	5,360	30	134
CD	3,548	30	90
DE	3,790	30	95



Influence Line Computations - Second Set
Load at B

Panel 1

$$\begin{aligned} -Q_A &= \frac{(.0942 \times 160 - 200)(.0866 \times 26.25 - .875 \times 30)}{2(2 - .0866)200} = 0.11 \\ -Q_B &= \frac{(.875 \times 30 - .0866 \times 26.25)}{2(2 - .0866)} = 6.28 \\ Q_{R1} &= \frac{(.875 \times 30 - .0866 \times 26.25)}{2(2 - .0866)200} = 0.31 \end{aligned}$$

Panel 2

$$\begin{aligned} -Q_B &= \frac{(.0463 \times 232 - 134)(.0443 \times 22.5 + .125 \times 30)}{2(2 - .0443)134} = -1.11 \\ -Q_C &= \frac{(-.125 \times 30 - .0443 \times 22.5)}{2(2 - .0443)} = -1.21 \\ Q_{R2} &= \frac{(-.125 \times 30 - .0443 \times 22.5)}{2(2 - .0443)134} = -.009 \end{aligned}$$

Panel 3

$$\begin{aligned} -Q_C &= \frac{(.0507 \times 136 - 90)(.0482 \times 18.75 + .125 \times 30)}{2(2 - .0482)90} = -1.10 \\ -Q_D &= \frac{(-.125 \times 30 - .0482 \times 18.75)}{2(2 - .0482)} = -1.19 \\ Q_{R3} &= \frac{(-.125 \times 30 - .0482 \times 18.75)}{2(2 - .0482)90} = -0.13 \end{aligned}$$

Panel 4

$$\begin{aligned} -Q_D &= \frac{-95(.125 \times 30)}{4 \times 95} = -.94 \\ -Q_E &= \frac{(-.125 \times 30)}{4} = -.94 \\ Q_{R4} &= \frac{(-.125 \times 30)}{4 \times 95} = -.01 \end{aligned}$$

Panel 5

$$-Q_E = \frac{-1.25 \times 30}{4} = -.94$$

$$-Q_F = \frac{-1.25 \times 30}{4} = -.94$$

$$Q_{E5} = \frac{-1.25 \times 30}{4 \times 95} = -.0099$$

Panel 6

$$-Q_G = \frac{(.0507 \times 136 - 90)(-.0482 \times 11.25 + .125 \times 30)}{2(2 - .0482)90} = -.76$$

$$-Q_F = \frac{(-1.25 \times 30 + .0482 \times 11.25)}{2(2 - .0482)} = -.82$$

$$Q_{R6} = \frac{(-.125 \times 30 + .0482 \times 11.25)}{2(2 - .0482)90} = -.0091$$

Panel 7

$$-Q_H = \frac{(.0463 \times 134 - 134)(-.0443 \times 7.5 + .125 \times 30)}{2(2 - .0443)134} = -.81$$

$$-Q_G = \frac{(-.125 \times 30 + .0443 \times 7.5)}{2(2 - .0443)} = -.87$$

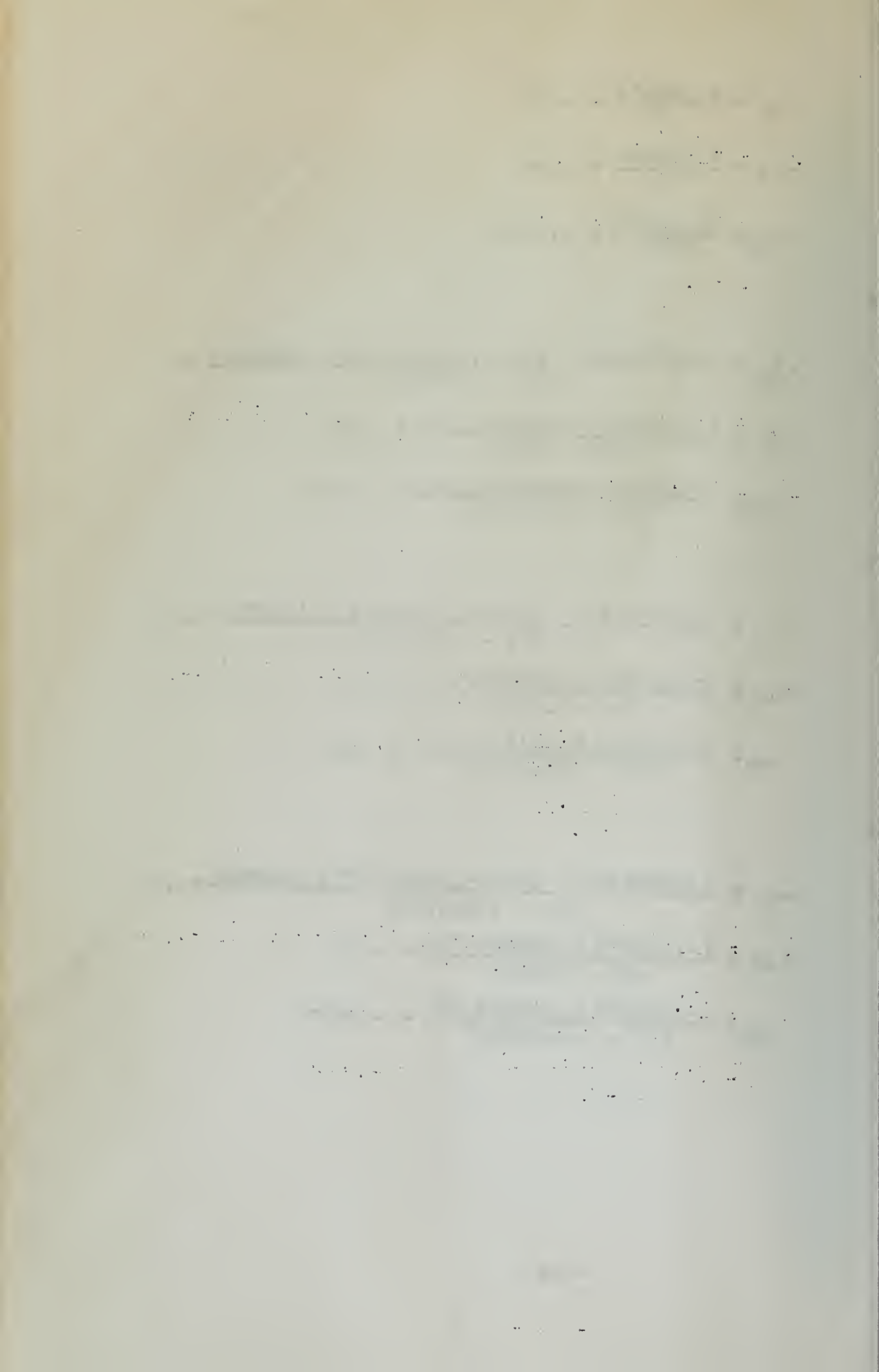
$$Q_{R7} = \frac{(-.125 \times 30 + .0443 \times 7.5)}{2(2 - .0443)134} = -.065$$

Panel 8

$$-Q_I = \frac{(.0942 \times 160 - 200)(-.0866 \times 3.75 + .125 \times 30)}{2(2 - .0866)200} = -.83$$

$$-Q_H = \frac{(-.125 \times 30 + .0866 \times 3.75)}{2(2 - .0866)} = -.90$$

$$Q_{R8} = \frac{(-.125 \times 30 + .0866 \times 3.75)}{2(2 - .0866)200} = -.0045$$



Panel 1

$$-Q_A = \frac{(.0942 \times 160 - 200)(.0866 \times 22.5 - .75 \times 30)}{2(2 - .0866)200} = 4.98$$

$$-Q_B = \frac{(.75 \times 30 - .0866 \times 22.5)}{2(2 - .0866)} = 5.38$$

$$Q_{R1} = \frac{(.75 \times 30 - .0866 \times 22.5)}{2(2 - .0866)200} = 0.27$$

Panel 2

$$-Q_B = \frac{(.0463 \times 232 - 134)(.0443 \times 45 - .75 \times 30)}{2(2 - .0443)134} = 4.82$$

$$-Q_C = \frac{(.75 \times 30 - .0443 \times 45)}{2(2 - .0443)} = 5.24$$

$$Q_{R2} = \frac{(.75 \times 30 - .0443 \times 45)}{2(2 - .0443)134} = 0.39$$

Panel 3

$$-Q_C = \frac{(.0507 \times 136 - 90)(.0482 \times 37.5 + .25 \times 30)}{2(2 - .0482)90} = -2.20$$

$$-Q_D = \frac{(-.25 \times 30 - .0482 \times 37.5)}{2(2 - .0482)} = -2.39$$

$$Q_{R3} = \frac{-.25 \times 30 - .0482 \times 37.5}{2(2 - .0482)90} = -.027$$

Panel 4

$$-Q_D = \frac{(-95)(.25 \times 30)}{4 \times 95} = -1.87$$

$$-Q_E = \frac{(-.25 \times 30)}{4} = -1.87$$

$$Q_{R4} = \frac{-.25 \times 30}{4 \times 95} = -.020$$

1. The first part of the paper is devoted to a general discussion of the problem of the existence of solutions of the system of equations

$$\frac{dx}{dt} = P(x, y, z), \quad \frac{dy}{dt} = Q(x, y, z), \quad \frac{dz}{dt} = R(x, y, z),$$

where P, Q, R are continuous functions of x, y, z in a certain domain.

2. In the second part we consider the case when the functions P, Q, R are linear in x, y, z .

$$\frac{dx}{dt} = a_1x + b_1y + c_1z, \quad \frac{dy}{dt} = a_2x + b_2y + c_2z, \quad \frac{dz}{dt} = a_3x + b_3y + c_3z,$$

where a_i, b_i, c_i are constants.

3. In the third part we consider the case when the functions P, Q, R are quadratic in x, y, z .

4. In the fourth part we consider the case when the functions P, Q, R are cubic in x, y, z .

5. In the fifth part we consider the case when the functions P, Q, R are of higher order in x, y, z .

6. In the sixth part we consider the case when the functions P, Q, R are of arbitrary order in x, y, z .

7. In the seventh part we consider the case when the functions P, Q, R are of arbitrary order in x, y, z .

8. In the eighth part we consider the case when the functions P, Q, R are of arbitrary order in x, y, z .

9. In the ninth part we consider the case when the functions P, Q, R are of arbitrary order in x, y, z .

10. In the tenth part we consider the case when the functions P, Q, R are of arbitrary order in x, y, z .

11. In the eleventh part we consider the case when the functions P, Q, R are of arbitrary order in x, y, z .

Panel 5

$$-Q_E = -1.88$$

$$-Q_F = -1.88$$

$$Q_{R5} = -.020$$

Panel 6

$$-Q_F = -1.64$$

$$-Q_G = -1.52$$

$$Q_{R6} = -.018$$

Panel 7

$$-Q_G = -1.74$$

$$-Q_H = -1.62$$

$$Q_{R7} = -.013$$

Panel 8

$$-Q_H = -1.80$$

$$-Q_I = -1.66$$

$$Q_{R8} = -.0090$$

Load at D

Panel 1

$$-Q_A = \frac{(.0942 \times 160 - 200)(.0866 \times 18.75 - .625 \times 30)}{2(2 - .0866)200} = 4.15$$

$$-Q_B = \frac{.625 \times 30 - .0866 \times 18.75}{2(2 - .0866)} = 4.49$$

$$Q_{R1} = \frac{.625 \times 30 - .0866 \times 18.75}{2(2 - .0866)200} = .022$$

Panel 2

$$-Q_B = \frac{(.0463 \times 232 - 134)(.0443 \times 37.5 - .625 \times 30)}{2(2 - .0443)134} = 4.02$$

$$-Q_C = \frac{(.625 \times 30 - .0443 \times 37.5)}{2(2 - .0443)} = 4.36$$

$$Q_{R2} = \frac{(.625 \times 30 - .0443 \times 37.5)}{2(2 - .0443)134} = .033$$

Panel 3

$$-Q_C = \frac{(.0507 \times 136 - 90)(.0482 \times 56.25 - .625 \times 30)}{2(2 - .0482)90} = 3.80$$

$$-Q_D = \frac{(.625 \times 30 - .0482 \times 56.25)}{2(2 - .0482)} = 4.12$$

$$Q_{R3} = \frac{(.625 \times 30 - .0482 \times 56.25)}{2(2 - .0482)90} = .046$$

Panel 4

$$-Q_D = \frac{(-.95)(.375 \times 30)}{4 \times 95} = -2.81$$

$$-Q_E = \frac{(-.375 \times 30)}{4} = -2.81$$

$$Q_{R4} = \frac{(-.375 \times 30)}{4 \times .95} = .030$$

1870

1871

1872

1873

1874

1875

1876

1877

1878

1879

1880

1881

Panel 5

$$-Q_E = -2.82$$

$$-Q_F = -2.82$$

$$Q_{R5} = -.030$$

Panel 6

$$-Q_F = -2.46$$

$$-Q_G = -2.28$$

$$Q_{R6} = -0.27$$

Panel 7

$$-Q_G = -2.61$$

$$-Q_H = -2.43$$

$$Q_{R7} = -.020$$

Panel 8

$$-Q_H = -2.70$$

$$-Q_I = -2.49$$

$$Q_{R8} = -.014$$

1870
1871
1872

1873
1874
1875

1876
1877
1878

1879
1880
1881

Load at E

Panel 1

$$-Q_A = \frac{(.0942 \times 160 - 200)(.0866 \times 15 - .5 \times 30)}{2(2 - .0866)200} = 3.32$$

$$-Q_B = \frac{(.5 \times 30 - .0866 \times 15)}{2(2 - .0866)} = 3.59$$

$$Q_{R1} = \frac{(.5 \times 30 - .0866 \times 15)}{2(2 - .0866)200} = .018$$

Panel 2

$$-Q_B = \frac{(.0463 \times 132 - 134)(.0443 \times 30 - .5 \times 30)}{2(2 - .0443)134} = 3.22$$

$$-Q_C = \frac{(.5 \times 30 - .0443 \times 30)}{2(2 - .0443)} = 3.49$$

$$Q_{R2} = \frac{(.5 \times 30 - .0443 \times 30)}{2(2 - .0443)134} = .026$$

Panel 3

$$-Q_C = \frac{(.0507 \times 136 - 90)(.0482 \times 45 - .5 \times 30)}{2(2 - .0482)90} = 3.04$$

$$-Q_D = \frac{(.5 \times 30 - .0482 \times 45)}{2(2 - .0482)} = 3.30$$

$$Q_{R3} = \frac{(.5 \times 30 - .0482 \times 45)}{2(2 - .0482)90} = .037$$

Panel 4

$$-Q_D = \frac{(-95)(-.5 \times 30)}{4 \times 95} = 3.75$$

$$-Q_E = \frac{(.5 \times 30)}{4} = 3.75$$

$$Q_{R4} = \frac{.5 \times 30}{4 \times 95} = .040$$

My dear Mr. Brewster,

I have just received your letter of the 17th inst.

and am glad to hear from you.

I have been very busy lately, but I have managed to find some time to write you.

I have been thinking of you very much lately, and I hope you are well.

I have been very busy lately, but I have managed to find some time to write you.

I have been thinking of you very much lately, and I hope you are well.

I have been very busy lately, but I have managed to find some time to write you.

I have been thinking of you very much lately, and I hope you are well.

I have been very busy lately, but I have managed to find some time to write you.

I have been thinking of you very much lately, and I hope you are well.

I have been very busy lately, but I have managed to find some time to write you.

Panel 5

$$-Q_E = -3.78$$

$$-Q_F = -3.78$$

$$Q_{R5} = -.040$$

Panel 6

$$-Q_E = -3.28$$

$$-Q_G = -3.04$$

$$Q_{R6} = -.036$$

Panel 7

$$-Q_G = -3.48$$

$$-Q_H = -3.24$$

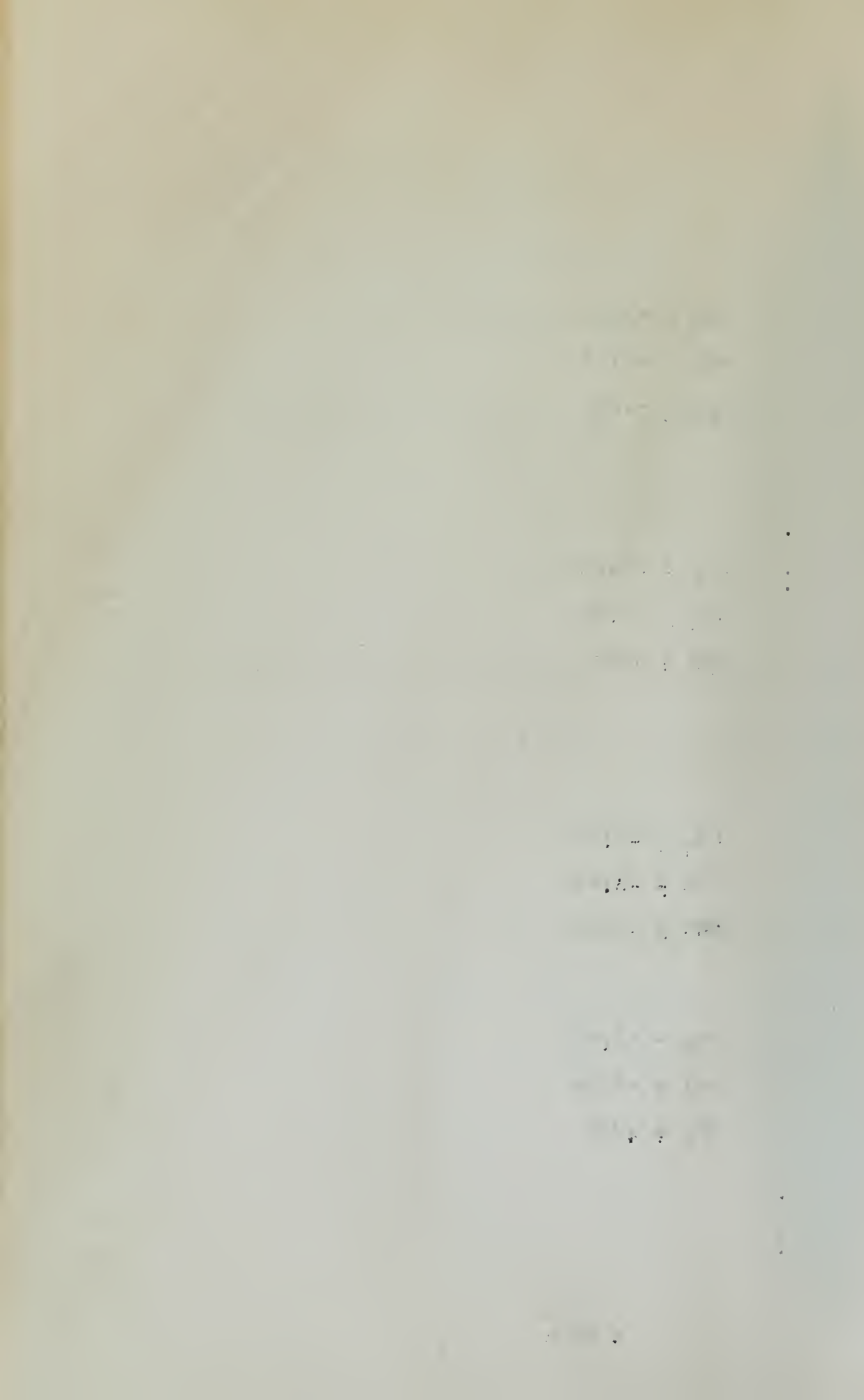
$$Q_{R7} = -.026$$

Panel 8

$$-Q_H = -3.60$$

$$-Q_I = -3.32$$

$$Q_{R8} = .018$$



Panel Constant Computations Load at B

Panel 1

$$\left[1.5 \times 160 + 200 + \frac{(3 - .0866)(.0942 \times 160 - 200)}{2(2 - .0866)} \right] A + \left[\frac{200}{2} + \frac{(3 - .1734)(.0942 \times 160 - 200)}{2(2 - .0866)} \right] B = 5.82$$

$$299A - 37B = 5.82$$

$$\left[200 + 1.5 \times 232 - \frac{(3 - .1732)200}{2(2 - .0866)} \right] B + \left[\frac{200}{2} - \frac{(3 - .0866)200}{2(2 - .0866)} \right] A = 6.28$$

$$400B - 52A = 6.28$$

Solving Simultaneously: $A = .022$ $B = .019$

$$R_1 = \frac{(3 - .0866)(.022) + (3 - .1732)(.019)}{2(2 - .0866)} + .031 = .062$$

Panel 2

$$\left[1.5 \times 232 + 134 + \frac{(3 - .0443)(.0463 \times 232 - 134)}{2(2 - .0443)} \right] B + \left[\frac{134}{2} + \frac{(3 - .0886)(.0463 \times 232 - 134)}{2(2 - .0443)} \right] C = -1.11$$

$$\left[134 + 1.5 \times 136 - \frac{(3 - .0886)134}{2(2 - .0443)} \right] C + \left[\frac{134}{2} - \frac{(3 - .0443)134}{2(2 - .0443)} \right] B = -1.21$$

$$238C - 34B = -1.21$$

Solving Simultaneously: $B = -.003$ $C = -.005$

$$R_2 = \frac{(3 - .0443)(-.003) + (3 - .0886)(-.005)}{2(2 - .0443)} - .009 = -.015$$

$$S_{11} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

where

$$S_{11} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

and

$$S_{11} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$S_{11} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$S_{11} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$S_{11} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$S_{11} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Panel 3

$$.5x136 + 90 + \frac{(3-.0482)(.0507x136-90)}{2(2-.0482)} \Big] C \Big[\frac{90 + (3-.0964)(.0507x136-90)}{2} \frac{1}{2(2-.0482)} \Big]$$

$$D = -1.10$$

$$231C - 17D = 1.10$$

$$0 + 1.5x74 - \frac{(3-.0964)90}{2(2-.0482)} \Big] D + \frac{90 - (3-.0482)90}{2} \Big] C = -1.19$$

$$134D - 23C = -1.19$$

Solving Simultaneously: $C = -.0055; D = -.0098$

$$R_3 = \frac{(3-.0482)(-.0055) + (3-.0964)(-.0098)}{2(2-.0482)} - .013 = -.024$$

Panel 4

$$.5x74 + 95 + \frac{(3)(0-95)}{4} \Big] D + \frac{95 + (3)(0-95)}{2} \Big] E = -.94$$

$$135D - 24E = -.94$$

$$+ 1.5x47 - \frac{(3)95}{4} \Big] E + \frac{95 - (3)95}{2} \Big] D = -.94$$

$$94E - 24D = -.94$$

Solving Simultaneously $D = -.0092; E = -.012$

$$R_4 = \frac{3(-.0092) + 3(-.012)}{4} - .01 = -.026$$

1. The first part of the document is a list of names and addresses of the members of the committee.

2. The second part of the document is a list of names and addresses of the members of the committee.

3. The third part of the document is a list of names and addresses of the members of the committee.

4. The fourth part of the document is a list of names and addresses of the members of the committee.

5. The fifth part of the document is a list of names and addresses of the members of the committee.

6. The sixth part of the document is a list of names and addresses of the members of the committee.

7. The seventh part of the document is a list of names and addresses of the members of the committee.

8. The eighth part of the document is a list of names and addresses of the members of the committee.

Panel 5

$$135E - 24F = -.94$$

$$-24E + 94F = -.94$$

$$E = -.012$$

$$F = -.0092$$

$$R_5 = \frac{3}{4} (-.0092 - .012) - .0099 = -.026$$

Panel 6

$$134F - 23G = -.82$$

$$-17F + 231G = -.76$$

$$F = -.0068$$

$$G = -.0039$$

$$R_6 = \frac{-2.95 \times .0039 - 2.90 \times .0068}{3.90} - .0091 = -.0173$$

Panel 7

$$238G - 34H = -.87$$

$$-25G + 389H = -.81$$

$$G = -.0040$$

$$H = -.0023$$

$$R_7 = \frac{-2.96 \times .0023 - 2.91 \times .0040}{3.91} - .0065 = -.0112$$

Panel 8

$$400H - 52I = -.90$$

$$-37H + 299I = -.83$$

$$H = -.0027$$

$$I = -.0031$$

$$R_8 = \frac{-2.91 \times .0031 - 2.83 \times .0027}{3.83} - .0045 = -.0088$$

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Panel Constant Computations - Load at C

Panel 1

$$299A - 37B = 4.98$$

$$-52A + 400B = 5.38$$

$$A = .019 , B = .016$$

$$R_1 = \frac{2.91(.019) + 2.83(.016)}{2(1.91)} + .027 = .053$$

Panel 2

$$389B - 25C = 4.82$$

$$-34B + 238C = 5.24$$

$$B = .014 , C = .024$$

$$R_2 = \frac{2.96(.014) + (2.91)(.024)}{3.92} + .039 = .067$$

Panel 3

$$231C - 17D = -2.20$$

$$-23C + 134D = -2.39$$

$$C = -.011 , D = -.020$$

$$R_3 = \frac{2.95(-.011) + 2.90(-.020)}{3.90} + (-.027) = -.050$$

Panel 4

$$135D - 24E = -1.87$$

$$-24D + 94E = -1.87$$

$$D = -.018 , E = -.025$$

$$R_4 = \frac{3(-.018) + 3(-.025)}{4} + (-.020) = -.052$$

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[illegible text]

[illegible text]

Panel 5

$$E = -.024$$

$$F = -.018$$

$$R_5 = -.052$$

Panel 6

$$F = -.014$$

$$G = -.0078$$

$$R_6 = -.034$$

Panel 7

$$G = -.0080$$

$$H = -.0046$$

$$R_7 = -.022$$

Panel 8

$$H = -.0054$$

$$I = -.0062$$

$$R_8 = -.018$$

Panel Constant Computations - Load at PP3

Panel 1

$$299A - 37B = 4.15$$

$$-52A + 400B = 4.49$$

Solving Simultaneously; $A = .016$, $B = .013$

$$R_1 = \frac{2.91(.016) + 2.83(.013)}{3.82} + .022 = .044$$

Panel 2

$$389B - 25C = 4.02$$

$$-34B + 238C = 4.36$$

Solving Simultaneously; $B = .012$, $C = .020$

$$R_2 = \frac{2.96(.012) + 2.91(.020)}{3.92} + .033 = .057$$

Panel 3

$$231C - 17D = 3.80$$

$$-23C + 134D = 4.12$$

Solving Simultaneously; $C = .019$, $D = .034$

$$R_3 = \frac{2.95(.019) + 2.90(.034)}{3.90} + .046 = .086$$

Panel 4

$$135D - 24E = -2.81$$

$$-24D + 94E = -2.81$$

Solving Simultaneously; $D = -.027$, $E = -.037$

$$R_4 = \frac{3(-.027) + 3(-.037)}{4} + (-.03) = -.078$$

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Panel 5

$$E = -.036$$

$$F = -.028$$

$$R_5 = -.078$$

Panel 6

$$F = +.020$$

$$G = -.012$$

$$R_6 = -.051$$

Panel 7

$$G = -.012$$

$$H = -.0069$$

$$R_7 = -.033$$

Panel 8

$$H = -.0081$$

$$I = -.0093$$

$$R_8 = -.026$$

Panel Constant Computations - Load at E

Panel 1

$$299A - 37B = 3.32$$

$$-52A + 400B = 3.59$$

$$A = .012, B = .011$$

$$R_1 = \frac{2.91(.012) + 2.83(.011)}{3.82} + .018 = .035$$

Panel 2

$$389B - 25C = 3.22$$

$$-34B + 238C = 3.49$$

$$B = .009, C = .016$$

$$R_2 = \frac{2.96(.009) + 2.91(.016)}{3.92} + .026 = .045$$

Panel 3

$$231C - 17D = 3.04$$

$$-23C + 134D = 3.30$$

$$C = .015, D = .027$$

$$R_3 = \frac{2.95(.015) + 2.90(.027)}{3.90} + .037 = .069$$

Panel 4

$$135D - 24E = 3.75$$

$$-24D + 94E = 3.75$$

$$D = .036, E = .049$$

$$R_4 = \frac{3(.036) + 3(.049)}{4} + .040 = .10$$

Panel 5

$$E = -.048$$

$$F = -.037$$

$$R_5 = -.104$$

Panel 6

$$F = -.027$$

$$G = -.016$$

$$R_6 = -.068$$

Panel 7

$$G = -.016$$

$$H = -.0092$$

$$R_7 = -.044$$

Panel 8

$$H = -.011$$

$$I = -.012$$

$$R_8 = -.035$$

Moment Determination

Load at PPl

$$M = K(A + \frac{B}{2} - R) \quad FM_{AB}$$

Panel 1

$$M_{AB} = 200(.022 + \frac{.019}{2} - .062) \quad M_{AB} = -6.0$$

$$M_{BA} = 200(.019 + \frac{.022}{2} - .062) \quad M_{BA} = -6.4$$

Panel 2

$$M_{BC} = 134(-.003 - \frac{.005}{2} + .015) \quad M_{BC} = +1.21$$

$$M_{CB} = 134(-.005 - \frac{.003}{2} + .015) \quad M_{CB} = +1.07$$

Panel 3

$$M_{CD} = 90(-.0055 - \frac{.0098}{2} + .024) \quad M_{CD} = +1.26$$

$$M_{DC} = 90(-.0098 - \frac{.0055}{2} + .024) \quad M_{DC} = +0.99$$

Panel 4

$$M_{DE} = 95(-.0092 - \frac{.012}{2} + .026) \quad M_{DE} = +1.05$$

$$M_{ED} = 95(-.012 - \frac{.0092}{2} + .026) \quad M_{ED} = +.86$$

Panel 5

$$M_{EF} = 2.58$$

$$M_{FE} = 2.97$$

Panel 6

$$M_{FG} = 2.16$$

$$M_{GF} = 2.70$$

Panel 7

$$M_{GH} = 2.40$$

$$M_{HG} = 2.82$$

Panel 8

$$M_{HI} = 2.76$$

$$M_{IH} = 2.58$$

1. The first part of the paper discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the success of any business and for the protection of the interests of all parties involved.

2. The second part of the paper describes the various methods that can be used to collect and analyze data. It discusses the advantages and disadvantages of each method and provides examples of how they can be applied in practice.

3. The third part of the paper discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the success of any business and for the protection of the interests of all parties involved.

4. The fourth part of the paper describes the various methods that can be used to collect and analyze data. It discusses the advantages and disadvantages of each method and provides examples of how they can be applied in practice.

5. The fifth part of the paper discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the success of any business and for the protection of the interests of all parties involved.

6. The sixth part of the paper describes the various methods that can be used to collect and analyze data. It discusses the advantages and disadvantages of each method and provides examples of how they can be applied in practice.

1. The first part of the paper discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the success of any business and for the protection of the interests of all parties involved.

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Load at PP2

Panel 1

$$M_{AB} = 200\left(.019 + \frac{.016}{2} - .053\right) \quad M_{AB} = -5.20$$

$$M_{BA} = 200\left(.016 + \frac{.019}{2} - .053\right) \quad M_{BA} = -5.40$$

Panel 2

$$M_{BC} = 134\left(.014 + \frac{.024}{2} - .067\right) \quad M_{BC} = -5.49$$

$$M_{CB} = 134\left(.024 + \frac{.014}{2} - .067\right) \quad M_{CB} = -4.82$$

Panel 3

$$M_{CD} = 90\left(-.011 - \frac{.020}{2} + .050\right) \quad M_{CD} = +2.61$$

$$M_{DC} = 90\left(-.020 - \frac{.011}{2} + .050\right) \quad M_{DC} = +2.16$$

Panel 4

$$M_{DE} = 95\left(-.018 - \frac{.025}{2} + .052\right) \quad M_{DE} = +2.09$$

$$M_{ED} = 95\left(-.025 - \frac{.018}{2} + .052\right) \quad M_{ED} = +1.71$$

Panel 5

$$M_{EF} = 3.44$$

$$M_{FE} = 3.96$$

Panel 6

$$M_{FG} = 2.88$$

$$M_{GF} = 3.60$$

Panel 7

$$M_{GH} = 3.20$$

$$M_{HG} = 3.76$$

Panel 8

$$M_{HI} = 3.68$$

$$M_{IH} = 3.44$$

Load at PF3

Panel 1

$$M_{AB} = 200\left(.016 + \frac{.013}{2} - .044\right) \quad M_{AB} = -4.40$$

$$M_{BA} = 200\left(.013 + \frac{.016}{2} - .044\right) \quad M_{BA} = -4.60$$

Panel 2

$$M_{BC} = 134\left(.012 + \frac{.020}{2} - .057\right) \quad M_{BC} = -4.69$$

$$M_{CB} = 134\left(.020 + \frac{.012}{2} - .057\right) \quad M_{CB} = -4.15$$

Panel 3

$$M_{CD} = 90\left(.019 + \frac{.034}{2} - .086\right) \quad M_{CD} = -4.50$$

$$M_{DC} = 90\left(.034 + \frac{.019}{2} - .086\right) \quad M_{DC} = -3.78$$

Panel 4

$$M_{DE} = 95\left(-.027 - \frac{.037}{2} + .078\right) \quad M_{DE} = 3.14$$

$$M_{ED} = 95\left(-.037 - \frac{.027}{2} + .078\right) \quad M_{ED} = 2.56$$

Panel 5

$$M_{EF} = 95\left(-.012 - \frac{.0092}{2} + .026\right) \quad M_{EF} = .86$$

$$M_{FE} = 95\left(-.0092 - \frac{.012}{2} + .026\right) \quad M_{FE} = .99$$

Panel 6

$$M_{FG} = 90\left(-.0068 - \frac{.0039}{2} + .017\right) \quad M_{FG} = .72$$

$$M_{GF} = 90\left(-.0039 - \frac{.0068}{2} + .017\right) \quad M_{GF} = .90$$

Panel 7

$$M_{GH} = 134\left(-.0040 - \frac{.0023}{2} + .011\right) \quad M_{GH} = .80$$

$$M_{HG} = 134\left(-.0023 - \frac{.0040}{2} + .011\right) \quad M_{HG} = .94$$

Panel 8

$$M_{HI} = 200\left(-.0027 - \frac{.0031}{2} + .0088\right) \quad M_{HI} = .92$$

$$M_{IH} = 200\left(-.0031 - \frac{.0027}{2} + .0088\right) \quad M_{IH} = .86$$

Load at PF4

Panel 1

$$M_{AB} = 200\left(.012 + \frac{.011}{2} - .035\right)$$

$$M_{AB} = -3.40$$

$$M_{BA} = 200\left(.011 + \frac{.012}{2} - .035\right)$$

$$M_{BA} = -3.60$$

Panel 2

$$M_{BC} = 134\left(.009 + \frac{.016}{2} - .045\right)$$

$$M_{BC} = -3.75$$

$$M_{CB} = 134\left(.016 + \frac{.009}{2} - .045\right)$$

$$M_{CB} = -3.35$$

Panel 3

$$M_{CD} = 90\left(.015 + \frac{.027}{2} - .069\right)$$

$$M_{CD} = -3.69$$

$$M_{DC} = 90\left(.027 + \frac{.015}{2} - .069\right)$$

$$M_{DC} = -3.15$$

Panel 4

$$M_{DE} = 95\left(.036 + \frac{.049}{2} - 0.10\right)$$

$$M_{DE} = -3.80$$

$$M_{ED} = 95\left(.049 + \frac{.036}{2} - 0.10\right)$$

$$M_{ED} = -3.13$$

Panel 5

$$M_{EF} = 1.72$$

$$M_{FE} = 1.98$$

Panel 6

$$M_{FG} = 1.44$$

$$M_{GF} = 1.80$$

Panel 7

$$M_{GH} = 1.60$$

$$M_{HG} = 1.88$$

Panel 8

$$M_{HI} = 1.84$$

$$M_{IH} = 1.72$$

First Moment Corrections - Load at B

1 -

$$299A - 37B = 0$$

$$-52A + 400B = -1.21$$

$$A = -.00038$$

$$B = -.0031$$

$$R_1 = \frac{-2.91 \times .00038 - 2.83 \times .0031}{3.83} = -.0026$$

$$M_{AB} = 200(-.00038 - \frac{1}{2} \times .0031 + .0026) = 0.14$$

$$M_{BA} = 200(-.0031 - \frac{1}{2} \times .00038 + .0026) = -0.14$$

2 -

$$388B - 25C = 6.4$$

$$-34B + 238C = -1.26$$

$$B = .016$$

$$C = -.0030$$

$$R_2 = \frac{2.96 \times .016 - 2.91 \times .003}{3.91} = .0099$$

$$M_{BC} = 134(.016 - \frac{1}{2} \times .0030 - .0099) = 0.62$$

$$M_{CB} = 134(-.0030 + \frac{1}{2} \times .016 - .0099) = -0.66$$

3

$$271C - 17D = -1.07$$

$$-23C + 134D = -1.05$$

$$C = -.0055$$

$$D = -.0088$$

$$R_3 = \frac{-2.95 \times .0055 - 2.90 \times .0088}{3.90} = -.011$$

$$M_{CD} = 90(-.0055 - \frac{1}{2} \times .0088 + .011) = 0.072$$

$$M_{DC} = 90(-.0088 - \frac{1}{2} \times .0055 + .011) = -0.072$$

4 -

$$\begin{aligned} 94D - 24E &= -.99 \\ -24D + 135E &= -.86 \\ D &= -.013 \\ E &= -.0086 \end{aligned}$$

$$\begin{aligned} R_4 &= \frac{3}{4}(-.013 - .0086) = -.016 \\ M_{DE} &= 95(-.013 - \frac{1}{2}x.0086 + .016) = -.10 \\ M_{ED} &= 95(-.0086 - \frac{1}{2}x.013 + .016) = +.10 \end{aligned}$$

5 -

$$\begin{aligned} 135E - 24F &= -.86 \\ -24E + 94F &= -.72 \\ E &= -.0080 \\ F &= -.0097 \end{aligned}$$

$$\begin{aligned} R_5 &= \frac{3}{4}(-.0080 - .0097) = -.013 \\ M_{EF} &= 95(-.0080 - \frac{1}{2}x.0097 + .013) = .05 \\ M_{FE} &= 95(-.0097 - \frac{1}{2}x.0080 + .013) = -.04 \end{aligned}$$

6 -

$$\begin{aligned} 134F - 23G &= -.99 \\ -17F + 231G &= -.80 \\ F &= -.0079 \\ G &= -.0040 \end{aligned}$$

$$\begin{aligned} R_6 &= \frac{-2.90x.0079 - 2.95x.0040}{3.90} = -.0090 \\ M_{FG} &= 90(-.0079 - \frac{1}{2}x.0040 + .0090) = -.08 \\ M_{GF} &= 90(-.0040 - \frac{1}{2}x.0079 + .0090) = .09 \end{aligned}$$

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1897-1898
1898-1899
1899-1900

7 -

$$238G - 34H = -.90$$

$$-25G + 388H = -.92$$

$$G = -.0040$$

$$H = -.0026$$

$$R_7 = \frac{-2.91 \times .0040 - 2.96 \times .0026}{3.91} = -.0049$$

$$M_{GH} = 134(-.0040 - \frac{1}{2} \times .0026 + .0049) = -.05$$

$$M_{HG} = 134(-.0026 - \frac{1}{2} \times .0040 + .0049) = .04$$

8 -

$$400H - 52I = -.94$$

$$-37H + 299I = 0.00$$

$$H = -.0024$$

$$I = -.0003$$

$$R_8 = \frac{-2.83 \times .0024 - 2.91 \times .0003}{3.83} = -.0020$$

$$M_{HI} = 200(-.0024 - \frac{1}{2} \times .0003 + .0020) = -0.10$$

$$M_{IH} = 200(-.0003 - \frac{1}{2} \times .0024 + .0020) = 0.10$$

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Load at B

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
-Q	5.82	6.28	-1.11	-1.21	-1.10	-1.19	- .94	- .94
α	.022	.019	-.003	-.005	-.0055	-.0098	-.0092	-.012
R	.062		-.015		-.024		-.026	
M'	-6.0	-6.4	1.21	1.07	1.26	0.99	1.05	0.86
-Q	0.00	-1.21	6.4	-1.26	-1.07	-1.05	-0.99	-0.86
α	-.0004	.0031	0.16	-.0030	-.0055	-.0088	-.013	-.0086
R	-.0026		-.0099		-.011		-.016	
M''	0.14	-0.14	0.62	-0.66	0.07	-0.07	- .10	.10
-Q								
α								
R								
M'''								
M	-5.86	-6.54	1.83	0.41	1.33	0.92	0.95	0.96

Name		Address		Occupation	
John	Smith	123	4th St	Farmer	
James	Johnson	456	7th St	Teacher	
William	Williams	789	10th St	Merchant	
Robert	Roberts	1011	13th St	Physician	
Thomas	Thomas	1213	16th St	Lawyer	
Charles	Charles	1415	19th St	Engineer	
Henry	Henry	1617	22nd St	Artist	
George	George	1819	25th St	Writer	
Edward	Edward	2021	28th St	Musician	
Frederick	Frederick	2223	31st St	Scientist	
Alfred	Alfred	2425	34th St	Historian	
Samuel	Samuel	2627	37th St	Philosopher	
Benjamin	Benjamin	2829	40th St	Statesman	
Lucas	Lucas	3031	43rd St	Religious Leader	
Timothy	Timothy	3233	46th St	Businessman	
Herbert	Herbert	3435	49th St	Explorer	
Carl	Carl	3637	52nd St	Explorer	
Harold	Harold	3839	55th St	Explorer	
Arthur	Arthur	4041	58th St	Explorer	
Alvin	Alvin	4243	61st St	Explorer	
Clarence	Clarence	4445	64th St	Explorer	
Harvey	Harvey	4647	67th St	Explorer	
Carl	Carl	4849	70th St	Explorer	
Arthur	Arthur	5051	73rd St	Explorer	
Alvin	Alvin	5253	76th St	Explorer	
Clarence	Clarence	5455	79th St	Explorer	
Harvey	Harvey	5657	82nd St	Explorer	
Carl	Carl	5859	85th St	Explorer	
Arthur	Arthur	6061	88th St	Explorer	
Alvin	Alvin	6263	91st St	Explorer	
Clarence	Clarence	6465	94th St	Explorer	
Harvey	Harvey	6667	97th St	Explorer	
Carl	Carl	6869	100th St	Explorer	

Continued on next page

5		6		7		8	
E	F	F	G	G	H	H	I
-0.94	-0.94	-0.82	-0.76	-0.87	-0.81	-0.90	-0.83
-0.12	-.0092	-.0068	-.0039	-.0040	-.0023	-.0027	-.0031
-.026		-.017		-.011		-.0088	
0.86	0.99	0.72	0.90	0.80	0.94	0.92	0.86
-0.86	-0.72	-0.99	-0.80	-0.90	-0.92	-0.94	0.00
-.0080	-.0097	-.0079	-.0040	-.0040	-.0026	-.0024	-.0003
-.013		-.0090		-.0049		-.0020	
.05	-.04	-.08	.09	-.05	.04	-.10	.10
0.91	0.95	0.64	0.99	0.75	0.98	0.82	0.96

First Moment Corrections - Load at C

$$1. \quad \begin{aligned} 299A - 37B &= 0 \\ -52A + 400B &= 5.49' \end{aligned}$$

$$\begin{aligned} A &= .0017 \\ B &= .014 \\ R_1 &= \frac{2.91 \times .0017 + 2.83 \times .014}{3.83} = .012 \end{aligned}$$

$$\begin{aligned} M_{AB} &= 200(.0017 + \frac{1}{2} \times .014 - .012) = -.60 \\ M_{BA} &= 200(.014 + \frac{1}{2} \times .0017 - .012) = .60 \end{aligned}$$

$$2. \quad \begin{aligned} 388B - 25C &= 5.40 \\ -34B + 238C &= -2.61 \end{aligned}$$

$$\begin{aligned} B &= .013 \\ C &= -.0091 \\ R_2 &= \frac{2.96 \times .013 - 2.91 \times .0091}{3.91} = .0031 \end{aligned}$$

$$\begin{aligned} M_{BC} &= 134(.013 - \frac{1}{2} \times .0091 - .0031) = .67 \\ M_{CB} &= 134(-.0091 + \frac{1}{2} \times .013 - .0031) = -.71 \end{aligned}$$

$$3. \quad \begin{aligned} 231C - 17D &= 4.82 \\ -23C + 134D &= -2.09 \end{aligned}$$

$$\begin{aligned} C &= .020 \\ D &= .012 \\ R_3 &= \frac{2.95 \times .02 - 2.90 \times .012}{3.90} = .0062 \end{aligned}$$

$$\begin{aligned} M_{CD} &= 90(.020 - \frac{1}{2} \times .012 - .0062) = .72 \\ M_{DC} &= 90(-.012 + \frac{1}{2} \times .020 - .0062) = -.72 \end{aligned}$$

$$4. \quad \begin{aligned} 94D - 24E &= -2.16 \\ -24D + 135E &= -1.72 \end{aligned}$$

$$\begin{aligned} D &= -.028 \\ E &= .018 \\ R_4 &= \frac{3}{4} (-.028 - .018) = -.035 \\ M_{DE} &= 95(-.028 - \frac{1}{2} \times .018 + .035) = -.23 \\ M_{ED} &= 95(-.018 - \frac{1}{2} \times .028 + .035) = .23 \end{aligned}$$

THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT

RESEARCH REPORT

ON THE THEORY OF THE

ATOMIC SPECTRA

BY

JOHN H. VAN VLECK

AND

WILLIAM F. FAY

CHICAGO, ILLINOIS

1927

PHYSICS DEPARTMENT

CHICAGO, ILLINOIS

1927

CHICAGO, ILLINOIS

5.

$$\begin{aligned}
 135E - 24F &= -1.71 \\
 -24E + 94F &= -1.44 \\
 E &= -.016 \\
 F &= -.019
 \end{aligned}$$

$$R_5 = \frac{3}{4} (-.016 - .019) = -.026$$

$$M_{EF} = 95(-.016 - \frac{1}{2} \times .019 + .026) = .10$$

$$M_{FE} = 95(-.016 - \frac{1}{2} \times .019 + .026) = -.10$$

6.

$$\begin{aligned}
 134F - 23G &= -1.98 \\
 -17F + 231G &= -1.60 \\
 F &= -.016 \\
 G &= -.008
 \end{aligned}$$

$$R_6 = \frac{-2.90 \times .008 - 2.95 \times .016}{3.90} = -.018$$

$$M_{FG} = 90(-.016 - \frac{1}{2} \times .008 + .018) = -.18$$

$$M_{GF} = 90(-.008 - \frac{1}{2} \times .016 + .018) = .18$$

7.

$$\begin{aligned}
 238G - 34H &= -1.80 \\
 -25G + 388H &= -1.84 \\
 G &= .0080 \\
 H &= .0052
 \end{aligned}$$

$$R_7 = \frac{-2.91 \times .0080 - 2.96 \times .0052}{3.91} = -.0098$$

$$M_{GH} = 134(-.0080 - \frac{1}{2} \times .0052 + .0098) = -.09$$

$$M_{HG} = 134(-.0080 - \frac{1}{2} \times .0052 + .0098) = .09$$

8.

$$\begin{aligned}
 400H - 52I &= -1.88 \\
 -37H + 299I &= 0 \\
 H &= -.0049 \\
 I &= -.0006
 \end{aligned}$$

$$R_8 = \frac{-2.83 \times .0049 - 2.91 \times .0006}{3.83} = -.0040$$

$$M_{HI} = 200(-.0049 - \frac{1}{2} \times .0006 + .0040) = -.20$$

$$M_{IH} = 200(-.0006 - \frac{1}{2} \times .0049 + .0040) = .20$$

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Second Moment Corrections-Load at C

1.

$$\begin{aligned} 299A - 37B &= 0 \\ -52A + 400B &= -.67 \\ A &= -.0002 \\ B &= -.0017 \end{aligned}$$

$$R_1 = \frac{-2.91 \times .0002 - 2.83 \times .0017}{3.83} = -.0014$$

$$M_{AB} = 200(-.0002 - \frac{1}{2} \times .0017 + .0014) = .08$$

$$M_{BA} = 200(-.0017 - \frac{1}{2} \times .0002 + .0014) = -.08$$

2.

$$\begin{aligned} 388B - 25C &= -.67 \\ -34B + 238C &= -.72 \\ B &= -.0020 \\ C &= -.0033 \end{aligned}$$

$$R_2 = \frac{-2.96 \times .0020 - 2.91 \times .0033}{3.91} = -.0040$$

$$M_{BC} = 134(-.0020 - \frac{1}{2} \times .0033 + .0040) = .05$$

$$M_{CB} = 134(-.0033 - \frac{1}{2} \times .0020 + .0040) = -.04$$

3.

$$\begin{aligned} 231C - 17D &= .71 \\ -23C + 134D &= .23 \\ C &= .0023 \\ D &= .0033 \end{aligned}$$

$$R_3 = \frac{2.95 \times .0023 + 2.90 \times .0033}{3.90} = .0042$$

$$M_{CD} = 90(.0023 + \frac{1}{2} \times .0033 - .0042) = -.03$$

$$M_{DC} = 90(.0033 + \frac{1}{2} \times .0023 - .0042) = .03$$

4.

$$\begin{aligned} 94D - 24E &= .72 \\ -24D + 135E &= -.10 \\ D &= .0076 \\ E &= .0006 \end{aligned}$$

$$R_4 = \frac{3}{4} (.0076 + .0006) = .0062$$

$$M_{DE} = 95(.0076 + \frac{1}{2} \times .0006 - .0062) = .16$$

$$M_{ED} = 95(.0006 + \frac{1}{2} \times .0076 - .0062) = -.16$$

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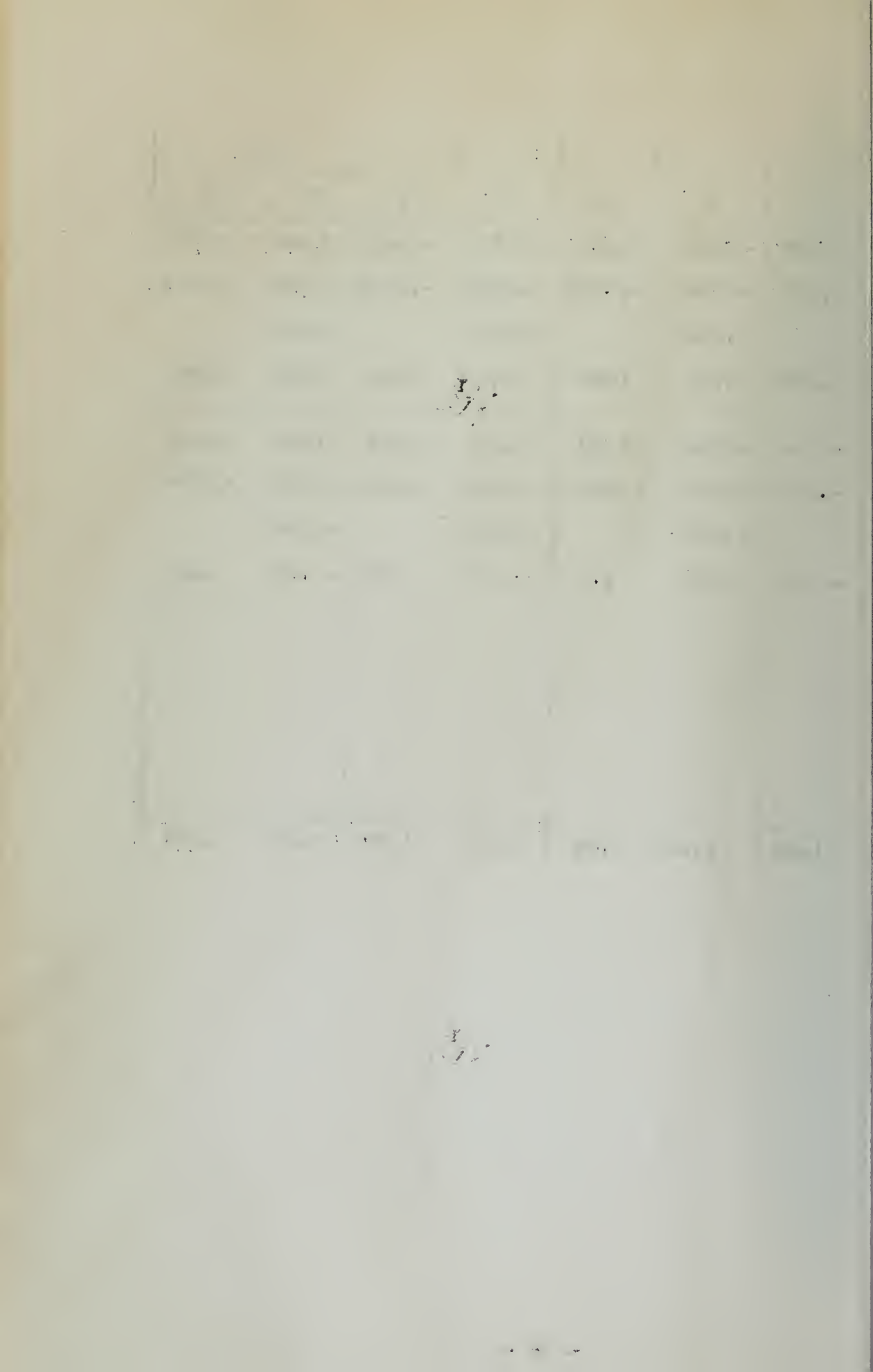
... ..

Load at C

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
Q	4.98	5.38	4.82	5.24	-2.20	-2.39	-1.87	-1.87
X	.019	.016	.014	.024	-.011	-.020	-.018	-.025
R	.053		.067		-.050		-.052	
M'	-5.20	-5.40	-5.49	-4.82	2.61	2.16	2.09	1.71
Q	0.00	5.49	5.40	-2.61	4.82	-2.09	-2.16	-1.72
X	.0017	.014	.013	-.0091	.020	-0.12	-0.28	-.018
R	.012		-.0031		.0062		-.035	
M''	-.60	.60	.67	-.71	.72	-.72	-.23	.23
Q	0.00	-.67	-.67	-.72	.71	.23	.72	-.10
X	-.0002	-.0017	-.0020	-.0033	.0023	.0033	.0076	.0006
R	-.0014		-.0040		.0042		.0062	
M'''	.08	-.08	.05	-.04	-.03	.03	.16	-.16
M	-5.72	-4.88	-4.77	-5.57	3.29	1.47	2.02	1.78

Jan 1	1887	Jan 1	1887	Jan 1	1887	Jan 1	1887
Jan 2	1887	Jan 2	1887	Jan 2	1887	Jan 2	1887
Jan 3	1887	Jan 3	1887	Jan 3	1887	Jan 3	1887
Jan 4	1887	Jan 4	1887	Jan 4	1887	Jan 4	1887
Jan 5	1887	Jan 5	1887	Jan 5	1887	Jan 5	1887
Jan 6	1887	Jan 6	1887	Jan 6	1887	Jan 6	1887
Jan 7	1887	Jan 7	1887	Jan 7	1887	Jan 7	1887
Jan 8	1887	Jan 8	1887	Jan 8	1887	Jan 8	1887
Jan 9	1887	Jan 9	1887	Jan 9	1887	Jan 9	1887
Jan 10	1887	Jan 10	1887	Jan 10	1887	Jan 10	1887
Jan 11	1887	Jan 11	1887	Jan 11	1887	Jan 11	1887
Jan 12	1887	Jan 12	1887	Jan 12	1887	Jan 12	1887
Jan 13	1887	Jan 13	1887	Jan 13	1887	Jan 13	1887
Jan 14	1887	Jan 14	1887	Jan 14	1887	Jan 14	1887
Jan 15	1887	Jan 15	1887	Jan 15	1887	Jan 15	1887
Jan 16	1887	Jan 16	1887	Jan 16	1887	Jan 16	1887
Jan 17	1887	Jan 17	1887	Jan 17	1887	Jan 17	1887
Jan 18	1887	Jan 18	1887	Jan 18	1887	Jan 18	1887
Jan 19	1887	Jan 19	1887	Jan 19	1887	Jan 19	1887
Jan 20	1887	Jan 20	1887	Jan 20	1887	Jan 20	1887
Jan 21	1887	Jan 21	1887	Jan 21	1887	Jan 21	1887
Jan 22	1887	Jan 22	1887	Jan 22	1887	Jan 22	1887
Jan 23	1887	Jan 23	1887	Jan 23	1887	Jan 23	1887
Jan 24	1887	Jan 24	1887	Jan 24	1887	Jan 24	1887
Jan 25	1887	Jan 25	1887	Jan 25	1887	Jan 25	1887
Jan 26	1887	Jan 26	1887	Jan 26	1887	Jan 26	1887
Jan 27	1887	Jan 27	1887	Jan 27	1887	Jan 27	1887
Jan 28	1887	Jan 28	1887	Jan 28	1887	Jan 28	1887
Jan 29	1887	Jan 29	1887	Jan 29	1887	Jan 29	1887
Jan 30	1887	Jan 30	1887	Jan 30	1887	Jan 30	1887
Jan 31	1887	Jan 31	1887	Jan 31	1887	Jan 31	1887

5		6		7		8	
E	F	F	G	G	H	H	I
-1.88	-1.88	-1.64	-1.52	-1.74	-1.62	-1.80	-1.66
-.024	-.018	-.014	-.0078	-.0080	-.0046	-.0054	-.0062
-.052		-.034		-.022		-.018	
1.72	1.98	1.44	1.80	1.60	1.88	1.84	1.72
-1.71	-1.44	-1.98	-1.60	-1.80	-1.84	-1.88	0.00
-.016	-.019	-.016	-.008	-.0080	-.0052	-.0049	-.0006
-.026		-.018		-.0098		-.0042	
.10	- .10	- .18	.18	- .09	.09	- .20	.20
1.82	1.88	1.26	1.98	1.51	1.97	1.64	1.92



Influence Lines - First Correction

Load at D

Panel 1

$$299A - 37B = 0$$

$$-52A + 400B = 4.69$$

$$A = .001$$

$$B = .012$$

$$R_1 = .010$$

$$M_{AB} = 200(.001 + \frac{1}{2}x.012 - .01) = -.60$$

$$M_{BA} = 200(.012 + \frac{1}{2}x.001 - .01) = .60$$

Panel 2

$$389B - 25C = 4.60$$

$$-34B + 238C = 4.50$$

$$B = .013$$

$$C = .021$$

$$R_2 = .025$$

$$M_{BC} = 134(.013 + \frac{1}{2}x.021 - .025) = -.27$$

$$M_{CB} = 134(.021 + \frac{1}{2}x.013 - .025) = .27$$

Panel 3

$$231C - 17D = 4.15$$

$$-23C + 134D = -3.14$$

$$C = .016$$

$$D = -.021$$

$$R_3 = -.003$$

$$M_{CD} = 90(.016 - \frac{1}{2}x.021 + .003) = .81$$

$$M_{DC} = 90(-.021 + \frac{1}{2}x.016 + .003) = -.90$$

Panel 4

$$135D - 24E = 3.78$$

$$-24D + 94E = -2.58$$

$$D = .024$$

$$E = -.021$$

$$R_4 = .002$$

$$M_{DE} = 95(.024 - \frac{1}{2}x.021 - .002) = 1.14$$

$$M_{ED} = 95(-.021 + \frac{1}{2}x.024 - .002) = -1.04$$

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Panel 5

$$-24E + 94F = -2.56$$

$$135F - 24E = -2.16$$

$$E = -.033$$

$$F = -.022$$

$$R_5 = -.041$$

$$M_{EF} = 95(-.033 - \frac{1}{2}x.022 + .041) = -.28$$

$$M_{FE} = 95(-.022 - \frac{1}{2}x.033 + .041) = .28$$

Panel 6

$$-23G + 134F = -2.97$$

$$231G - 17F = -2.40$$

$$F = -.024$$

$$G = -.012$$

$$R_6 = -.027$$

$$M_{FG} = 90(-.024 - \frac{1}{2}x.012 + .027) = -.27$$

$$M_{GF} = 90(-.012 - \frac{1}{2}x.024 + .027) = .27$$

Panel 7

$$-34H + 238G = -2.70$$

$$389H - 25G = -2.76$$

$$G = -.012$$

$$H = -.008$$

$$R_7 = -.015$$

$$M_{GH} = 134(-.012 - \frac{1}{2}x.008 + .015) = -.13$$

$$M_{HG} = 134(-.008 - \frac{1}{2}x.012 + .015) = .13$$

Panel 8

$$-52I + 400H = -2.82$$

$$299I - 37H = 0$$

$$H = -.001$$

$$I = -.007$$

$$R_8 = -.005$$

$$M_{HI} = 200(0 - \frac{1}{2}x.007 + .005) = .40$$

$$M_{IH} = 200(-.007 - \frac{1}{2}x0 + .005) = -.40$$

1. $\sigma_1 = 1$
 2. $\sigma_2 = 1$
 3. $\sigma_3 = 1$
 4. $\sigma_4 = 1$
 5. $\sigma_5 = 1$

6. $\sigma_6 = 1$
 7. $\sigma_7 = 1$

8. $\sigma_8 = 1$
 9. $\sigma_9 = 1$
 10. $\sigma_{10} = 1$
 11. $\sigma_{11} = 1$

12. $\sigma_{12} = 1$
 13. $\sigma_{13} = 1$

14. $\sigma_{14} = 1$
 15. $\sigma_{15} = 1$
 16. $\sigma_{16} = 1$
 17. $\sigma_{17} = 1$

18. $\sigma_{18} = 1$
 19. $\sigma_{19} = 1$

20. $\sigma_{20} = 1$
 21. $\sigma_{21} = 1$
 22. $\sigma_{22} = 1$
 23. $\sigma_{23} = 1$

24. $\sigma_{24} = 1$
 25. $\sigma_{25} = 1$

Influence Lines - Second Correction - Load at D

Panel 1

$$299A - 37B = 0$$

$$-53A + 400B = .27$$

$$A = 0$$

$$B = .0007$$

$$R_1 = 0$$

$$M_{AB} = 0$$

$$M_{BA} = 0$$

Panel 2

$$389B - 25C = -.60$$

$$-34B + 238C = -.81$$

$$B = -.0018$$

$$C = -.0037$$

$$R_2 = -.0041$$

$$M_{BC} = 134(-.0018 - \frac{1}{2}x.0037 + .0041) = .07$$

$$M_{CB} = 134(-.0037 - \frac{1}{2}x.0018 + .0041) = -.07$$

Panel 3

$$231C - 17D = -.27$$

$$-.23C + 134D = -1.14$$

$$C = -.0019$$

$$D = -.0088$$

$$R_3 = -.0080$$

$$M_{CD} = 90(-.0019 - \frac{1}{2}x.0088 + .0080) = .15$$

$$M_{DC} = 90(-.0088 - \frac{1}{2}x.0019 + .0080) = -.15$$

Panel 4

$$135D - 24E = .90$$

$$-24D + 94E = .28$$

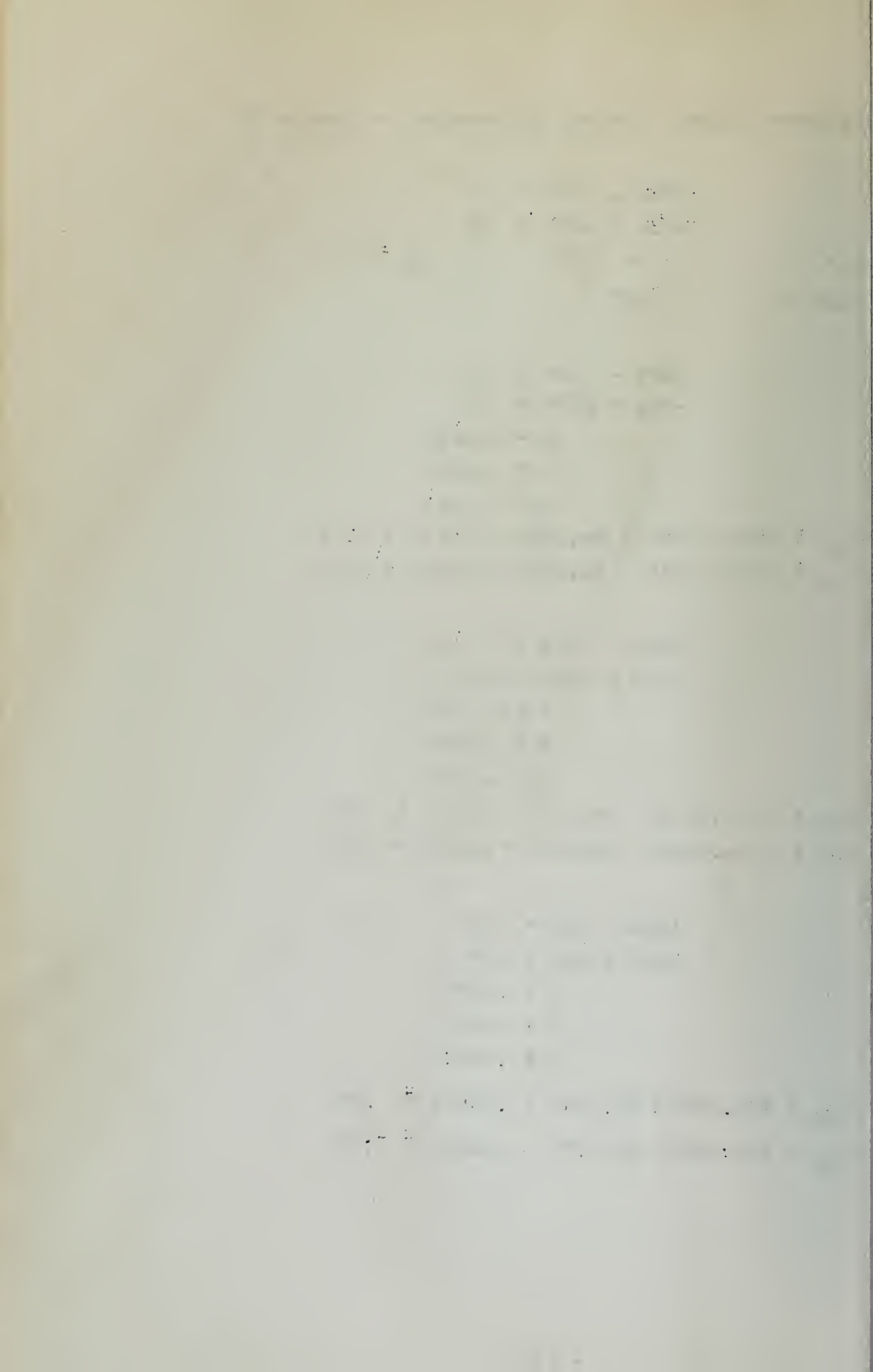
$$D = .0076$$

$$E = .0049$$

$$R_4 = .0094$$

$$M_{DE} = 95(.0076 + \frac{1}{2}x.0049 - .0094) = .07$$

$$M_{ED} = 95(.0049 + \frac{1}{2}x.0076 - .0094) = -.07$$



Panel 5

$$-24F + 94E = 1.04$$

$$135F - 24E = .27$$

$$E = .0121$$

$$F = .0042$$

$$R_5 = .0122$$

$$M_{EF} = 95(.0121 + \frac{1}{2} \times .0042 - .0122) = .19$$

$$M_{FE} = 95(.0042 + \frac{1}{2} \times .0121 - .0122) = -.19$$

Panel 6

$$-23G + 134F = -.28$$

$$231G - 17F = .13$$

$$F = -.0020$$

$$G = .0004$$

$$R_6 = -.0012$$

$$M_{FG} = 90(-.0020 + \frac{1}{2} \times .0004 + .0012) = -.05$$

$$M_{GF} = 90(.0004 - \frac{1}{2} \times .0020 + .0012) = .05$$

Panel 7

$$-34H + 238G = -.27$$

$$389H - 25G = -.40$$

$$G = -.0013$$

$$H = -.0011$$

$$R_7 = -.0018$$

$$M_{GH} = 134(-.0013 - \frac{1}{2} \times .0011 + .0018) = 0$$

$$M_{HG} = 134(-.0011 - \frac{1}{2} \times .0013 + .0018) = 0$$

Panel 8

$$-52I + 400H = -.13$$

$$299I - 37H = 0$$

$$H = -.0003$$

$$R_8 = 0$$

$$M_{IH} = 0$$

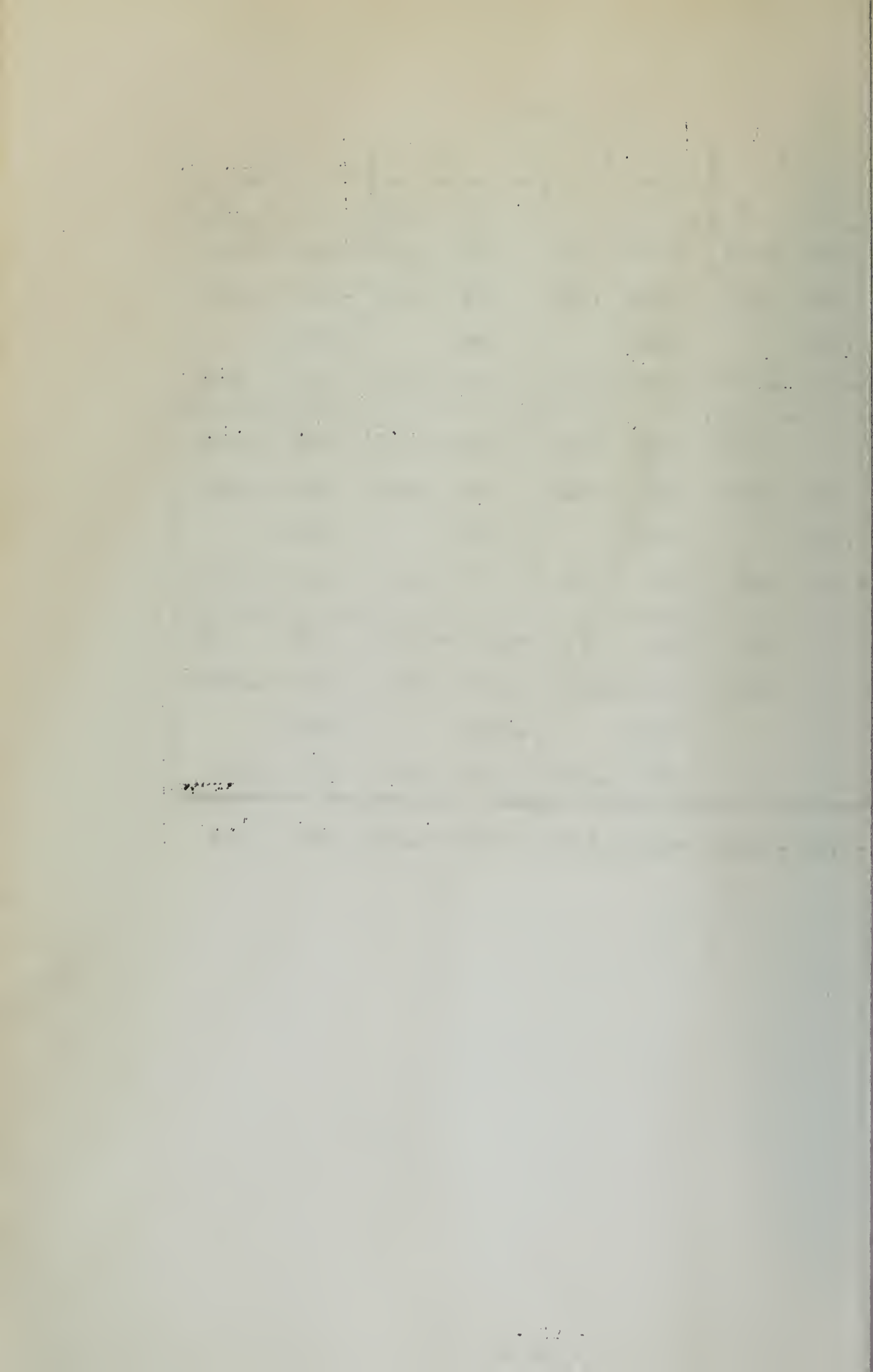
$$I = 0$$

$$M_{HI} = 0$$

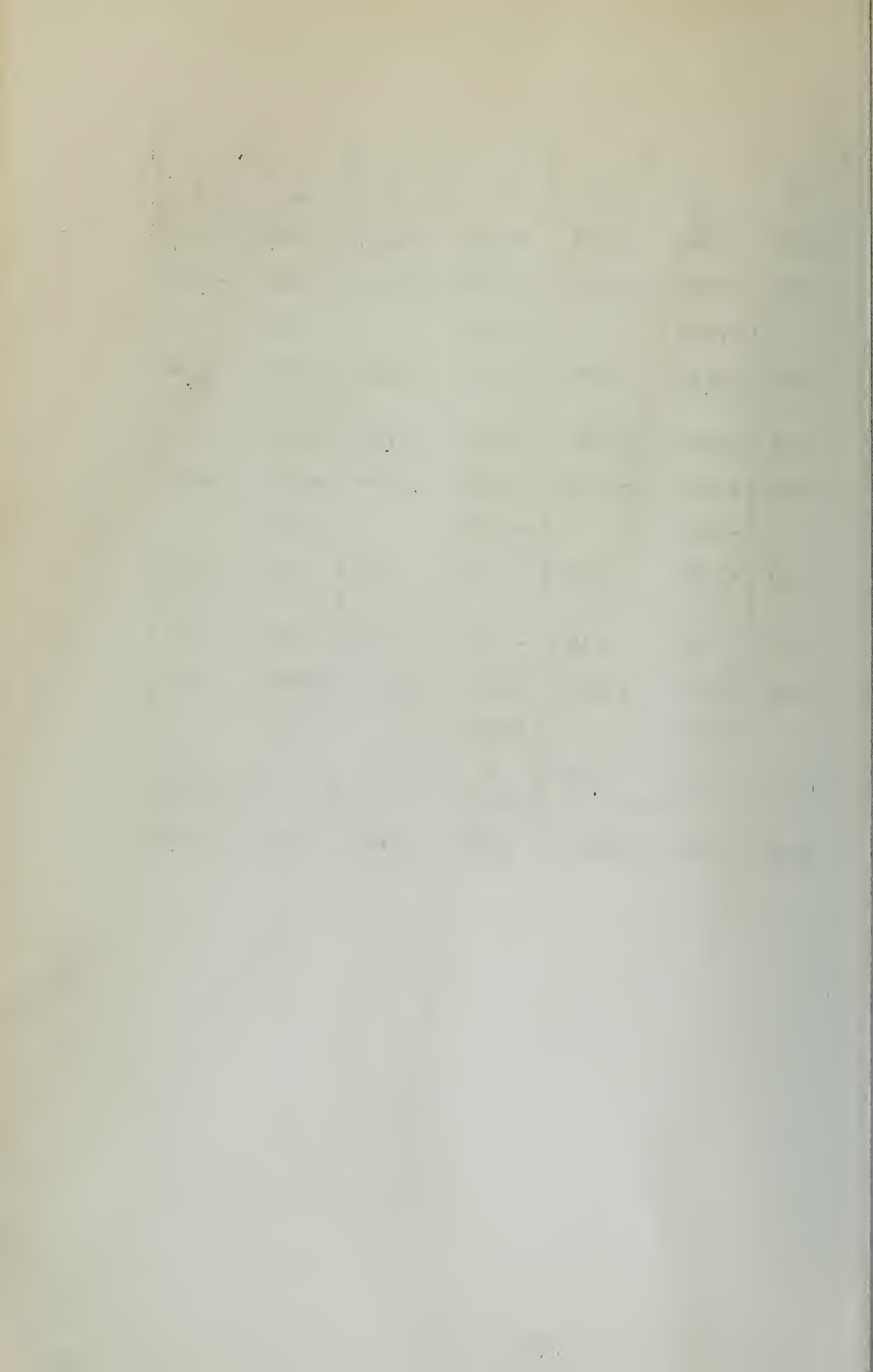
1. The first group of people who are interested in the study of the history of the world are the historians. They are people who study the past and try to understand what happened and why it happened. They use a variety of sources, including books, documents, and artifacts, to reconstruct the past. They also try to understand the people who lived in the past and how they thought and felt. Historians are interested in the history of the world because it helps them to understand the present and the future.

Load at PP3

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
-Q	4.15	4.49	4.02	4.36	3.80	4.12	-2.88	-2.81
α	.016	.013	.012	.020	.019	.034	-.027	-.037
R	.044		.057		.086		-.078	
M'	-4.40	-4.60	-4.69	-4.15	-4.50	-3.78	3.14	2.56
-Q	0	4.69	4.60	4.50	4.15	-3.14	3.78	-2.58
α	.001	.012	.031	.021	.016	-.021	.024	-.021
R	.010		.025		-.003		.002	
M''	-.60	.60	-.27	.27	.81	-.90	1.14	-1.04
-Q	0	.27	-.60	-.81	-.27	-1.14	.90	.28
α	0	.0007	-.0018	-.0037	-.0019	-.0083	.0076	.0049
R	0		-.0041		-.0080		.0094	
M'''	0	0	.07	-.07	.15	-.15	.07	-.07
M	-5.00	-4.00	-4.89	-3.95	-3.54	-4.83	4.35	1.45



5		6		7		8	
E	F	F	G	G	H	H	I
-2.82	-2.82	-2.46	-2.28	-2.61	-2.43	-2.70	-2.49
-.036	-.028	-.020	-.012	-.012	-.007	-.008	-.009
-.078		-.051		-.033		-.026	
2.58	2.97	2.16	2.70	2.40	2.82	2.76	2.58
-2.56	-2.16	-2.97	-2.40	-2.70	-2.76	-2.82	0
-.035	-.022	-.024	-.012	-.012	-.008	-.001	-.007
-.041		-.027		-.015		-.005	
-.26	.23	-.27	.27	-.13	.13	.40	-.40
1.04	.27	-.28	.13	-.27	-.40	-.13	0
.0121	.0042	-.0020	.0004	-.0013	-.0011	-.0003	0
.0122		-.0012		-.0018		0	
.19	-.19	-.05	.05	0	0	0	0
2.49	3.06	1.84	3.02	2.27	2.95	3.16	2.18



Influence Lines First Correction Load at E

Panel 1, 8

$$299A - 37B = 0$$

$$-52A + 100B = 3.76$$

$$A = .0012$$

$$B = .0095$$

$$R_1 = .0079$$

$$M_{AB} = 200(.0012 + \frac{1}{2} \times .0095 - .0079) = -.40$$

$$M_{BA} = 200(.0095 + \frac{1}{2} \times .0012 - .0079) = .40$$

Panel 2, 7

$$389B - 25C = -.21$$

$$-34B + 238C = 3.60$$

$$B = .0105$$

$$C = .0172$$

$$R_2 = .208$$

$$M_{EC} = 134(.0105 + \frac{1}{2} \times .0172 - .0208) = -.21$$

$$M_{CE} = 134(.0172 + \frac{1}{2} \times .0105 - .0208) = .21$$

Panel 3, 6

$$231C - 17D = 3.20$$

$$-23C + 134D = 3.96$$

$$C = .0162$$

$$D = .0324$$

$$R_3 = .0364$$

$$M_{CD} = 90(.0162 + \frac{1}{2} \times .0324 - .0362) = -.36$$

$$M_{DC} = 90(.0324 + \frac{1}{2} \times .0162 - .0362) = .36$$

Panel 4, 5

$$135D - 24E = 2.88$$

$$-24D + 94E = -3.44$$

$$D = .0155$$

$$E = -.0326$$

$$R_4 = -.0128$$

$$M_{DE} = 95(.0155 - \frac{1}{2} \times .0326 + .0128) = 1.14$$

$$M_{ED} = 95(-.0326 - \frac{1}{2} \times .0155 + .0128) = -1.14$$

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Influence Lines - Second Correction - Load at E

Panel 1,8

$$299A - 37B = 0$$

$$-52A + 400B = .21$$

$$A = .00007$$

$$B = .00053$$

$$R_1 = .00044$$

$$M_{AB} = 200(.00007 + \frac{1}{2}x.00053 - .00044) = -.02$$

$$M_{BA} = 200(.00053 + \frac{1}{2}x.00007 - .00044) = .02$$

Panel 2,7

$$389B - 25C = -.40$$

$$-34B + 238C = .36$$

$$B = -.00094$$

$$C = .00132$$

$$R_2 = .00027$$

$$M_{BC} = 134(-.00094 + \frac{1}{2}x.00132 - .00027) = -.08$$

$$M_{CB} = 134(.00132 - \frac{1}{2}x.00094 - .00027) = .08$$

Panel 3,6

$$231C - 17D = -.21$$

$$-23C + 134D = -1.14$$

$$C = -.0016$$

$$D = -.0088$$

$$R_3 = -.0077$$

$$M_{CD} = 90(-.0016 - \frac{1}{2}x.0088 + .0077) = .16$$

$$M_{DC} = 90(-.0088 - \frac{1}{2}x.0016 + .0077) = -.16$$

Panel 4,5

$$135D - 24E = -.21$$

$$-24D + 94E = 0$$

$$D = -.0016$$

$$E = -.0004$$

$$R_4 = -.0015$$

$$M_{DE} = 95(-.0016 - \frac{1}{2}x.0004 + .0015) = -.03$$

$$M_{ED} = 95(-.0004 - \frac{1}{2}x.0016 + .0015) = .03$$

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Volume 27, No. 19

CONTENTS
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Load at PP-4

Panel	1		2		3		4	
Joint	A	B	B	C	C	D	D	E
-Q	3.32	3.59	3.22	3.49	3.04	3.30	3.75	3.75
α	.012	.011	.009	.016	.015	.017	.036	.049
R	.035		.045		.069		.10	
M	-3.44	-3.68	-3.76	-3.20	-3.60	-2.88	-3.96	-3.44
-Q	0	3.76	3.68	3.60	3.20	3.96	2.88	-3.44
α	.0012	.0095	.0105	.0172	.0162	.0324	.0155	-.0326
R	.0079		.0208		.0364		-.0128	
M	-.40	.40	-.21	.21	-.36	.36	1.14	-1.14
-Q	0	.21	-.40	.36	-.21	-1.14	-.36	-1.14
α	.00007	.00053	.00049	.00132	-.0016	-.0088	-.0016	-.0004
R	.00044		.00027		-.0077		-.0015	
M	-.02	.02	-.08	.08	.16	-.16	-.03	.03
M	-3.86	-3.26	-4.05	-2.91	-3.80	-2.68	-2.85	-4.55

Year		1990		1991		1992		1993		1994		1995		1996		1997		1998		1999		2000		2001		2002		2003		2004		2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		2018		2019		2020		2021		2022		2023		2024		2025		2026		2027		2028		2029		2030		2031		2032		2033		2034		2035		2036		2037		2038		2039		2040		2041		2042		2043		2044		2045		2046		2047		2048		2049		2050		2051		2052		2053		2054		2055		2056		2057		2058		2059		2060		2061		2062		2063		2064		2065		2066		2067		2068		2069		2070		2071		2072		2073		2074		2075		2076		2077		2078		2079		2080		2081		2082		2083		2084		2085		2086		2087		2088		2089		2090		2091		2092		2093		2094		2095		2096		2097		2098		2099		2100		2101		2102		2103		2104		2105		2106		2107		2108		2109		2110		2111		2112		2113		2114		2115		2116		2117		2118		2119		2120		2121		2122		2123		2124		2125		2126		2127		2128		2129		2130		2131		2132		2133		2134		2135		2136		2137		2138		2139		2140		2141		2142		2143		2144		2145		2146		2147		2148		2149		2150		2151		2152		2153		2154		2155		2156		2157		2158		2159		2160		2161		2162		2163		2164		2165		2166		2167		2168		2169		2170		2171		2172		2173		2174		2175		2176		2177		2178		2179		2180		2181		2182		2183		2184		2185		2186		2187		2188		2189		2190		2191		2192		2193		2194		2195		2196		2197		2198		2199		2200		2201		2202		2203		2204		2205		2206		2207		2208		2209		2210		2211		2212		2213		2214		2215		2216		2217		2218		2219		2220		2221		2222		2223		2224		2225		2226		2227		2228		2229		2230		2231		2232		2233		2234		2235		2236		2237		2238		2239		2240		2241		2242		2243		2244		2245		2246		2247		2248		2249		2250		2251		2252		2253		2254		2255		2256		2257		2258		2259		2260		2261		2262		2263		2264		2265		2266		2267		2268		2269		2270		2271		2272		2273		2274		2275		2276		2277		2278		2279		2280		2281		2282		2283		2284		2285		2286		2287		2288		2289		2290		2291		2292		2293		2294		2295		2296		2297		2298		2299		2300		2301		2302		2303		2304		2305		2306		2307		2308		2309		2310		2311		2312		2313		2314		2315		2316		2317		2318		2319		2320		2321		2322		2323		2324		2325		2326		2327		2328		2329		2330		2331		2332		2333		2334		2335		2336		2337		2338		2339		2340		2341		2342		2343		2344		2345		2346		2347		2348		2349		2350		2351		2352		2353		2354		2355		2356		2357		2358		2359		2360		2361		2362		2363		2364		2365		2366		2367		2368		2369		2370		2371		2372		2373		2374		2375		2376		2377		2378		2379		2380		2381		2382		2383		2384		2385		2386		2387		2388		2389		2390		2391		2392		2393		2394		2395		2396		2397		2398		2399		2400		2401		2402		2403		2404		2405		2406		2407		2408		2409		2410		2411		2412		2413		2414		2415		2416		2417		2418		2419		2420		2421		2422		2423		2424		2425		2426		2427		2428		2429		2430		2431		2432		2433		2434		2435		2436		2437		2438		2439		2440		2441		2442		2443		2444		2445		2446		2447		2448		2449		2450		2451		2452		2453		2454		2455		2456		2457		2458		2459		2460		2461		2462		2463		2464		2465		2466		2467		2468		2469		2470		2471		2472		2473		2474		2475		2476		2477		2478		2479		2480		2481		2482		2483		2484		2485		2486		2487		2488		2489		2490		2491		2492		2493		2494		2495		2496		2497		2498		2499		2500		2501		2502		2503		2504		2505		2506		2507		2508		2509		2510		2511		2512		2513		2514		2515		2516		2517		2518		2519		2520		2521		2522		2523		2524		2525		2526		2527		2528		2529		2530		2531		2532		2533		2534		2535		2536		2537		2538		2539		2540		2541		2542		2543		2544		2545		2546		2547		2548		2549		2550		2551		2552		2553		2554		2555		2556		2557		2558		2559		2560		2561		2562		2563		2564		2565		2566		2567		2568		2569		2570		2571		2572		2573		2574		2575		2576		2577		2578		2579		2580		2581		2582		2583		2584		2585		2586		2587		2588		2589		2590		2591		2592		2593		2594		2595		2596		2597		2598		2599		2600		2601		2602		2603		2604		2605		2606		2607		2608		2609		2610		2611		2612		2613		2614		2615		2616		2617		2618		2619		2620		2621		2622		2623		2624		2625		2626		2627		2628		2629		2630		2631		2632		2633		2634		2635		2636		2637		2638		2639		2640		2641		2642		2643		2644		2645		2646		2647		2648		2649		2650		2651		2652		2653		2654		2655		2656		2657		2658		2659		2660		2661		2662		2663		2664		2665		2666		2667		2668		2669		2670		2671		2672		2673		2674		2675		2676		2677		2678		2679		2680		2681		2682		2683		2684		2685		2686		2687		2688		2689		2690		2691		2692		2693		2694		2695		2696		2697		2698		2699		2700		2701		2702		2703		2704		2705		2706		2707		2708		2709		2710		2711		2712		2713		2714		2715		2716		2717		2718		2719		2720		2721		2722		2723		2724		2725		2726		2727		2728		2729		2730		2731		2732		2733		2734		2735		2736		2737		2738		2739		2740		2741		2742		2743		2744		2745		2746		2747		2748		2749		2750		2751		2752		2753		2754		2755		2756		2757		2758		2759		2760		2761		2762		2763		2764		2765		2766		2767		2768		2769		2770		2771		2772		2773		2774		2775		2776		2777		2778		2779		2780		2781		2782		2783		2784		2785		2786		2787		2788		2789		2790		2791		2792		2793		2794		2795		2796		2797		2798		2799		2800		2801		2802		2803		2804		2805		2806		2807		2808		2809		2810		2811		2812		2813		2814		2815		2816		2817		2818		2819		2820		2821		28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F	F	F	G	G	H	H	I
-5.73	-3.78	-3.28	-3.04	-3.48	-3.24	-3.60	-3.32
.049	-.036	-.027	-.015	-.016	-.009	-.011	-.012
.10		-.069		-.045		-.035	
3.44	3.96	2.88	3.60	3.20	3.76	3.68	3.44
3.44	-2.88	-3.96	-3.20	-3.60	-3.68	-3.76	0
.0326	-.0155	-.0324	-.0162	-.0172	-.0105	-.0095	-.0012
.0128		-.0364		-.0208		-.0079	
1.14	-1.14	-.36	.36	-.21	.21	-.40	.40
1.14	.36	1.14	.21	-.36	.40	-.21	0
.0004	.0016	.0088	.0016	-.00132	.00094	-.00053	-.00007
.0015		.0077		-.00027		-.00044	
-.03	.03	.16	-.16	-.08	.08	-.02	.02
4.55	2.85	2.68	3.80	2.91	4.05	3.26	3.86

Moment Computations - Web Members

Member AA'

Dh	=	3140	fk
hh E-60	=	2755	
Impact	=	<u>590</u>	
Total		6485	
hh H-15-S12-44	=	367	
Conc.	=	86	
Impact	=	<u>62</u>	
Total		515	
Sidewalk	=	222	

Design Moment = 11,762 fk

Member BB'

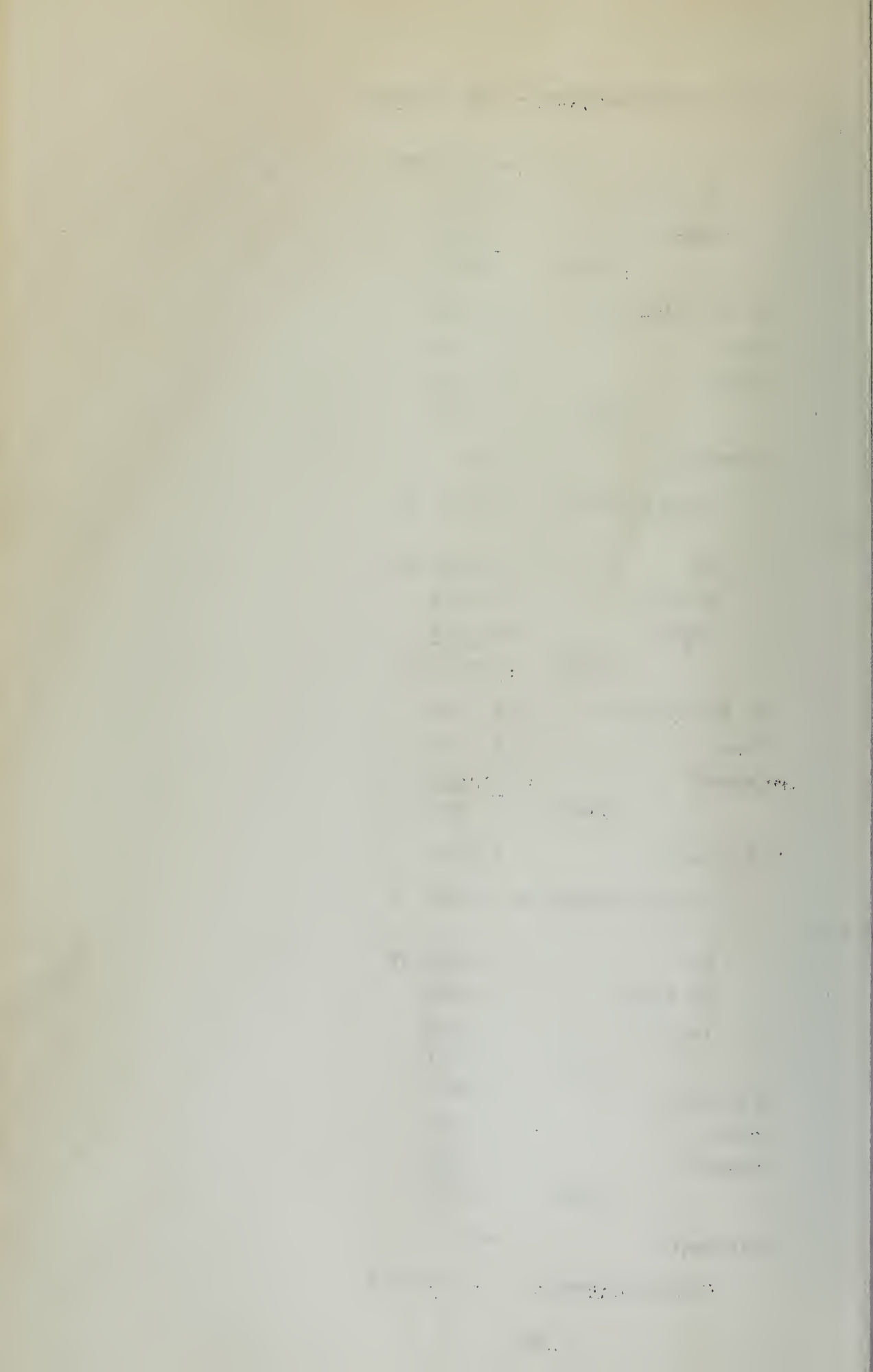
Dh	=	5180	fk
hh E-60	=	4423	
Impact	=	<u>947</u>	
Total		10,550	
hh H15-S12-44	=	606	
Conc.	=	142	
Impact	=	<u>102</u>	
Total		850	
Sidewalk	=	362	

Design Moment = 11,762 fk

Member CC'

Dh	=	3258	fk
hh E-60	=	2882	
Impact	=	<u>626</u>	
Total		6766	
hh H15-S12-44	=	381	
Conc.	=	109	
Impact	=	<u>77</u>	
Total		567	
Sidewalk	=	242	

Design Moment = 7,575 fk



Member DE

Dh	=	1830
hh-E-60	=	1652
Impact	=	<u>436</u>
Total		3948
hr H15-S12-44	=	215
Conc.	=	79
Impact	=	<u>53</u>
Total		347
Sidewalk	=	152
Design Moment	=	4,447

Member EE'

Dh	=	1156 fk
hh-E-60	=	1110
Impact	=	<u>389</u>
Total		2655
hr h15-S12-44	=	135
Conc.	=	64
Impact	=	<u>42</u>
Total		241
Sidewalk	=	104
Design Moment	=	3000 fk

Moment Computations - Chord Members

Member AB

DL	=	3140	fk
LL-E60	=	2755	
Impact	=	<u>590</u>	
Total		6485	
LL HL5-SL2-44	=	367	
Conc.	=	86	
Impact	=	<u>62</u>	
Total		515	
Sidewalk	=	222	
Design Moment	=	7,222	

Member BC

DL	=	2330	fk
LL-E60	=	2128	
Impact	=	<u>454</u>	
Total		4912	
LL HL5-SL2-44	=	273	
Conc.	=	80	
Impact	=	<u>55</u>	
Total		408	
Sidewalk	=	172	
Design Moment	=	5,492	fk

Member CD

DL	=	1525	fk
LL-E60	=	1382	
Impact	=	<u>321</u>	
Total	=	3128	
LL H15-S12-44	=	179	
Conc.	=	61	
Impact	=	<u>41</u>	
Total	=	281	
Sidewalk	=	120	
Design Moment	=	3,529	fk

Member DE

DL	=	1135	fk
LL-E60	=	1088	
Impact	=	<u>327</u>	
Total	=	2550	
LL H15-S12-44	=	133	
Conc.	=	62	
Impact	=	<u>37</u>	
Total	=	232	
Sidewalk	=	95	
Design Moment	=	2,877	fk

Influence Line Computations.

Load at B

Panel #1

$$-Q_A = \frac{(.0942 - 1)(.0866 \times 26.25 - .875 \times 30)}{2(2 - .0866)1} = 5.77$$

$$-Q_B = \frac{(.875 \times 30 - .0866 \times 26.25)}{2(2 - .0866)} = 6.28$$

$$Q_{R1} = \frac{.875 \times 30 - .0866 \times 26.25}{2(2 - .0866)1} = 6.28$$

Panel #2

$$-Q_B = \frac{(.0463 - 1)(.0443 \times 22.5 + .125 \times 30)}{2(2 - .0443)} = -1.15$$

$$-Q_C = \frac{(-.125 \times 30 - .0443 \times 22.5)}{2(2 - .0443)} = -1.21$$

$$Q_{R2} = \frac{-.125 \times 30 - .0443 \times 22.5}{2(2 - .0443)1} = -1.21$$

Panel #3

$$-Q_C = \frac{(.0507 - 1)(.0482 \times 18.75 + .125 \times 30)}{2(2 - .0482)1} = -1.13$$

$$-Q_D = \frac{-.125 \times 30 - .0482 \times 18.75}{2(2 - .0482)} = -1.19$$

$$Q_{R3} = \frac{-.125 \times 30 - .0482 \times 18.75}{2(2 - .0482)1} = -1.19$$

Panel #4

$$-Q_D = \frac{-1(.125 \times 30)}{4} = -.94$$

$$-Q_E = \frac{-.125 \times 30}{4} = -.94$$

$$Q_{R4} = \frac{-.125 \times 30}{4} = -.94$$

[illegible]

1. The first group of people who are interested in the study of the history of the United States are the people who are interested in the history of the United States.

100

C, g/l	R _p , %
0.0	100
0.2	85
0.4	70
0.6	55
0.8	40
1.0	20

1990

1

100

Panel 5

$$-Q_E = \frac{-.125 \times 30}{4} = -0.94$$

$$-Q_F = \frac{-.125 \times 30}{4} = -0.94$$

$$Q_{R5} = \frac{-.125 \times 30}{4 \times 1} = -0.94$$

Panel 6

$$-Q_G = \frac{(.0507 \times 1 - 1)(-.0482 \times 11.25 + .125 \times 30)}{2(2 - .0482)1} = -0.78$$

$$-Q_F = \frac{(-.125 \times 30 + .0482 \times 11.25)}{2(2 - .0482)} = -0.82$$

$$Q_{R6} = \frac{(-.125 \times 30 + .0482 \times 11.25)}{2(2 - .0482)1} = -0.82$$

Panel 7

$$-Q_H = \frac{(.0463 \times 1 - 1)(-.0443 \times 7.5 + .125 \times 30)}{2(2 - .0443)1} = -0.83$$

$$-Q_G = \frac{(-.125 \times 30 + .0443 \times 7.5)}{2(2 - .0443)} = -0.87$$

$$Q_{R7} = \frac{(-.125 \times 30 + .0443 \times 7.5)}{2(2 - .0443)1} = -0.87$$

Panel 8

$$-Q_I = \frac{(.0942 \times 1 - 1)(-.0866 \times 3.75 + .125 \times 30)}{2(2 - .0866)1} = -0.81$$

$$-Q_H = \frac{(-.125 \times 30 + .0866 \times 3.75)}{2(2 - .0866)} = -0.90$$

$$Q_{R8} = \frac{(-.125 \times 30 + .0866 \times 3.75)}{2(2 - .0866)} = -0.90$$

Load at C

Panel 1

$$-Q_A = \frac{(.0942 - 1)(.0866 \times 22.5 - .75 \times 30)}{2(2 - .0866)1} = 4.89$$

$$-Q_B = \frac{(.75 \times 30 - .0866 \times 22.5)}{2(2 - .0866)} = 5.38$$

$$Q_{R1} = \frac{.75 \times 30 - .0866 \times 22.5}{2(2 - .0866)1} = 5.38$$

Panel 2

$$-Q_B = \frac{(.0463 - 1)(.0443 \times 45 - .75 \times 30)}{2(2 - .0443)1} = 4.96$$

$$-Q_C = \frac{(.75 \times 30 - .0443 \times 45)}{2(2 - .0443)} = 5.23$$

$$Q_{R2} = \frac{.75 \times 30 - .0443 \times 45}{2(2 - .0443)1} = 5.23$$

Panel 3

$$-Q_C = \frac{(.0507 - 1)(.0482 \times 37.5 + .25 \times 30)}{2(2 - .0482)1} = -2.36$$

$$-Q_D = \frac{(-.25 \times 30 - .0482 \times 37.5)}{2(2 - .0482)} = -2.38$$

$$Q_{R3} = \frac{-.25 \times 30 - .0482 \times 37.5}{2(2 - .0482)1} = -2.38$$

Panel 4

$$-Q_D = \frac{-1(.25 \times 30)}{4} = -1.87$$

$$-Q_E = \frac{-.25 \times 30}{4} = -1.87$$

$$Q_{R4} = \frac{-.25 \times 30}{4} = -1.87$$

Panel 5

$$-Q_E = -1.88$$

$$-Q_F = -1.88$$

$$Q_{R5} = -1.88$$

Panel 6

$$-Q_H = -1.64$$

$$-Q_G = -1.56$$

$$Q_{R6} = -1.64$$

Panel 7

$$-Q_G = -1.74$$

$$-Q_H = -1.66$$

$$Q_{R7} = -1.74$$

Panel 8

$$-Q_H = -1.80$$

$$-Q_I = -1.62$$

$$Q_{R8} = -1.80$$

11-15

11-16

11-17

11-18

11-19

11-20

11-21

11-22

11-23

11-24

11-25

Load at D

Panel 1

$$-Q_A = \frac{(.0942 - 1)(.0866 \times 18.75 - .625 \times 30)}{2(2 - .0866)1} = 4.12$$

$$-Q_B = \frac{.625 \times 30 - .0866 \times 18.75}{2(2 - .0866)} = 4.49$$

$$Q_{R1} = \frac{.625 \times 30 - .0866 \times 18.75}{2(2 - .0866)1} = 4.49$$

Panel 2

$$-Q_B = \frac{(.0463 - 1)(.0443 \times 37.5 - .625 \times 30)}{2(2 - .0443)1} = 4.14$$

$$-Q_C = \frac{(.625 \times 30 - .0443 \times 37.5)}{2(2 - .0443)} = 4.36$$

$$Q_{R2} = \frac{.625 \times 30 - .0443 \times 37.5}{2(2 - .0443)1} = 4.36$$

Panel 3

$$-Q_C = \frac{(.0507 - 1)(.0482 \times 56.25 - .625 \times 30)}{2(2 - .0482)1} = 3.91$$

$$-Q_D = \frac{.625 \times 30 - .0482 \times 56.25}{2(2 - .0482)} = 4.12$$

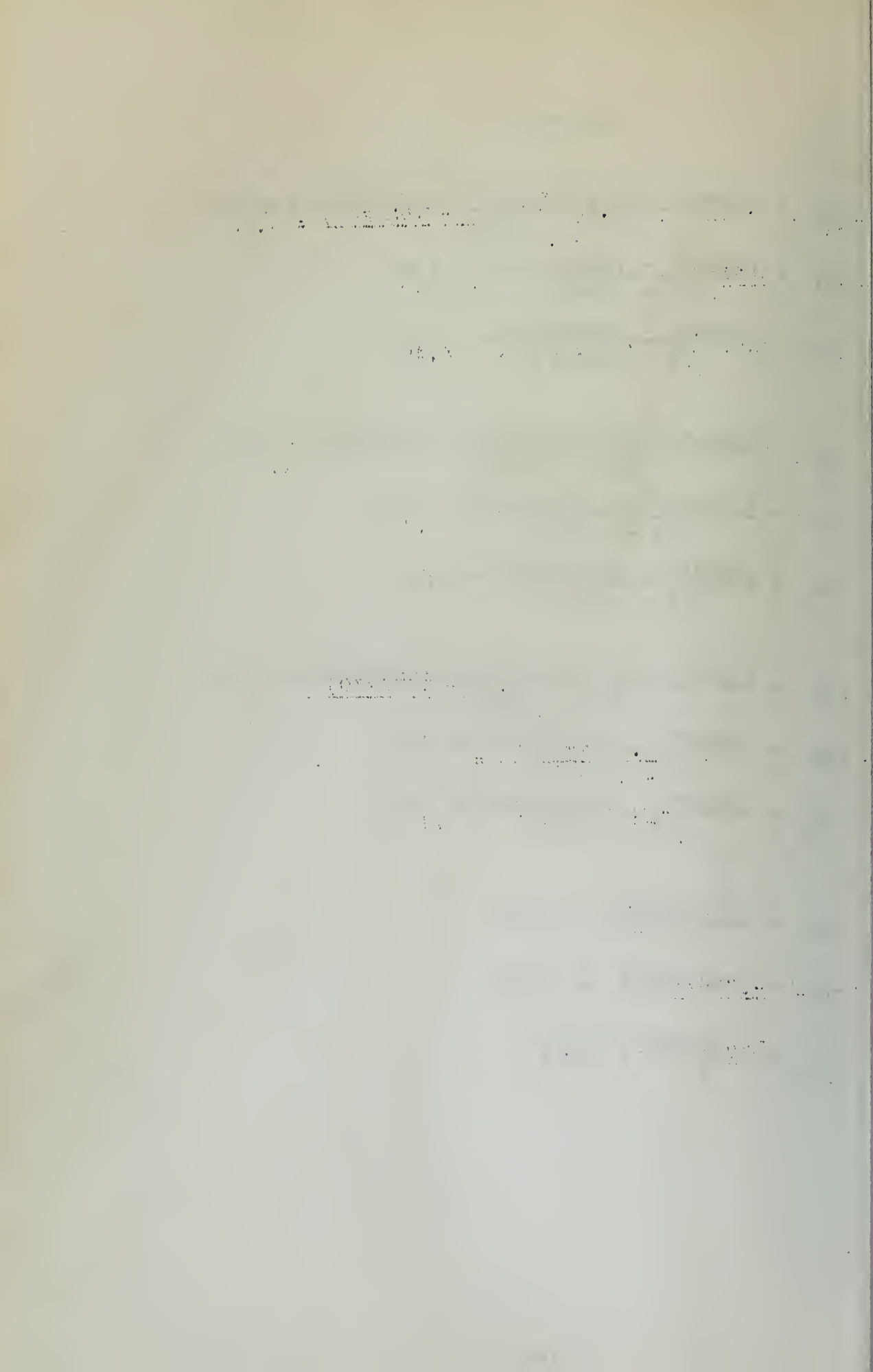
$$Q_{R3} = \frac{.625 \times 30 - .0482 \times 56.25}{2(2 - .0482)} = 4.12$$

Panel 4

$$-Q_D = \frac{-1(.375 \times 30)}{4} = -2.82$$

$$-Q_E = \frac{(-.375 \times 30)}{4} = -2.82$$

$$Q_{R4} = \frac{-.375 \times 30}{4} = -2.82$$



Panel 5

$$-Q_E = -2.82$$

$$-Q_F = -2.82$$

$$Q_{R5} = -2.82$$

Panel 6

$$-Q_F = -2.46$$

$$-Q_G = -2.34$$

$$Q_{R6} = -2.46$$

Panel 7

$$-Q_G = -2.61$$

$$-Q_H = -2.49$$

$$Q_{R7} = -2.61$$

Panel 8

$$-Q_H = -2.70$$

$$-Q_I = -2.43$$

$$Q_{R8} = -2.70$$



Load at E

Panel 1

$$-Q_A = \frac{(.0942 - 1)(.0866 \times 15 - .5 \times 30)}{2(2 - .0866)1} = 3.26$$

$$-Q_B = \frac{.5 \times 30 - .0866 \times 15}{2(2 - .0866)} = 3.59$$

$$Q_{R1} = \frac{.5 \times 30 - .0866 \times 15}{2(2 - .0866)1} = 3.59$$

Panel 2

$$-Q_B = \frac{(.0463 - 1)(.0443 \times 30 - .5 \times 30)}{2(2 - .0443)1} = 3.31$$

$$-Q_C = \frac{(.5 \times 30 - .0443 \times 30)}{2(2 - .0443)} = 3.49$$

$$Q_{R2} = \frac{.5 \times 30 - .0443 \times 30}{2(2 - .0443)1} = 3.49$$

Panel 3

$$-Q_C = \frac{(.0507 - 1)(.0482 \times 45 - .5 \times 30)}{2(2 - .0482)1} = 3.13$$

$$-Q_D = \frac{(.5 \times 30 - .0482 \times 45)}{2(2 - .0482)} = 3.30$$

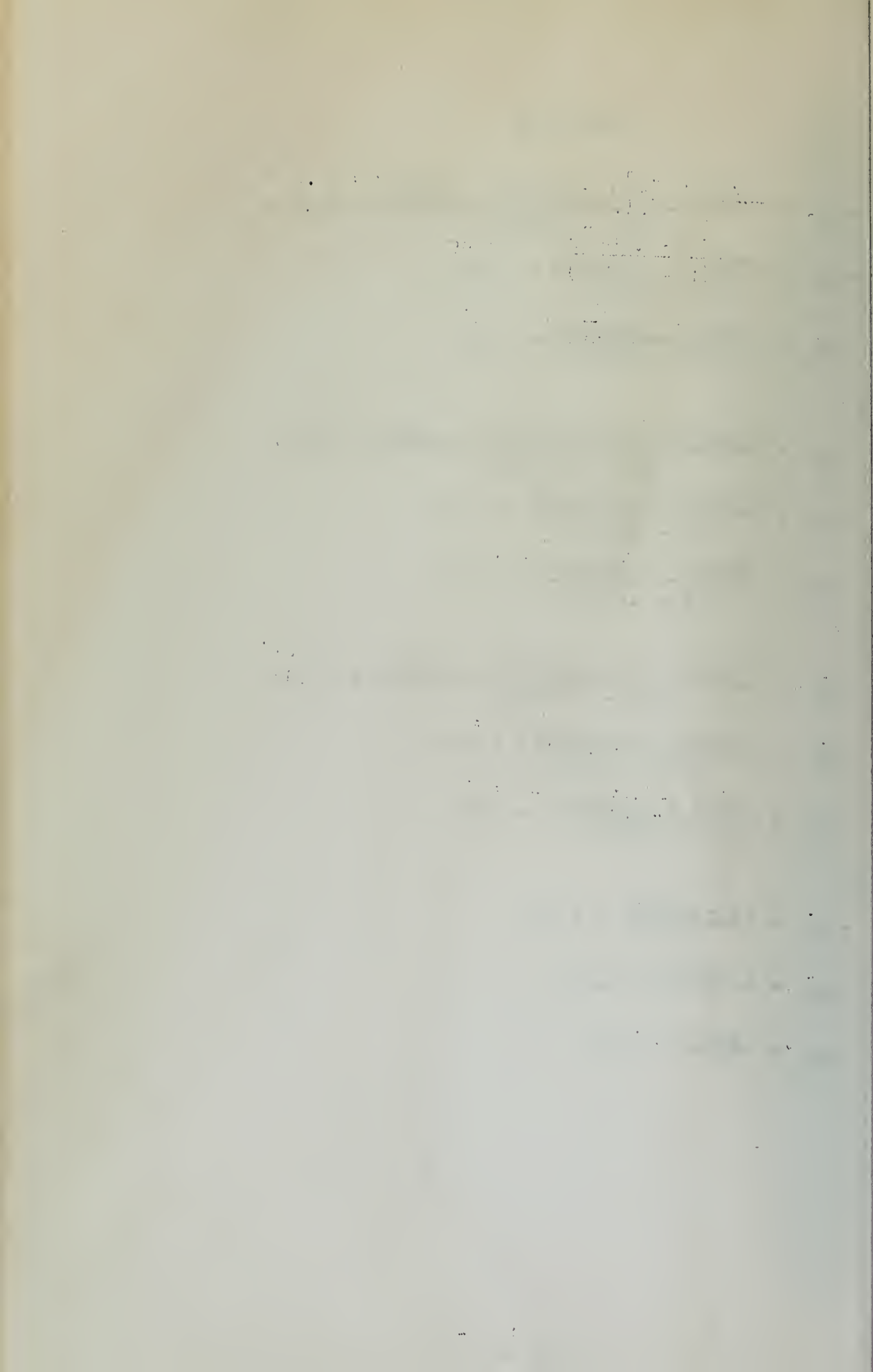
$$Q_{R3} = \frac{.5 \times 30 - .0482 \times 45}{2(2 - .0482)1} = 3.30$$

Panel 4

$$-Q_D = \frac{-1(-.5 \times 30)}{4} = 3.75$$

$$-Q_E = \frac{(.5 \times 30)}{4} = 3.75$$

$$Q_{R4} = \frac{.5 \times 30}{4} = 3.75$$



Panel 5

$$-Q_E = -3.76$$

$$-Q_F = -3.76$$

$$Q_{R5} = -3.76$$

Panel 6

$$-Q_E = -3.28$$

$$-Q_G = -3.12$$

$$Q_{R6} = -3.28$$

Panel 7

$$-Q_G = -3.48$$

$$-Q_H = -3.32$$

$$Q_{R7} = -3.48$$

Panel 8

$$-Q_H = -3.60$$

$$-Q_I = -3.24$$

$$Q_{R8} = -3.60$$

Equations for Determining Joint Constants

Panel 1

$$\left[1.5x1 + 1 + \frac{(3 - .0866)(.0942x1 - 1)}{2(2 - .0866)} \right] A + \left[\frac{1}{2} + \frac{(3 - 2x.0866)(.0942x1 - 1)}{2(2 - .0866)} \right] B = -Q_A$$

$$1.82A - .17B = -Q_A$$

$$\left[1 + 1.5x1 - \frac{(3 - 2x.0866)1}{2(2 - .0866)} \right] B + \left[\frac{1}{2} - \frac{(3 - .0866)1}{2(2 - .0866)} \right] A = -Q_B$$

$$1.76B - .26A = -Q_B$$

Panel 2

$$\left[1.5x1 + 1 + \frac{(3 - .0443)(.0463x1 - 1)}{2(2 - .0443)} \right] B + \left[\frac{1}{2} + \frac{(3 - 2x.0443)(.0463x1 - 1)}{2(2 - .0443)} \right] C = -Q_B$$

$$1.78B - .21C = -Q_B$$

$$\left[1 + 1.5x1 - \frac{(3 - 2x.0443)1}{2(2 - .0443)} \right] C + \left[\frac{1}{2} + \frac{(3 - .0443)1}{2(2 - .0443)} \right] B = -Q_C$$

$$1.76C - .26B = -Q_C$$

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Panel 3

$$\left[1.5x1 + 1 + \frac{(3 - .0482)(.0507x1 - 1)}{2(2 - .0482)} \right] C + \left[\frac{1}{2} + \frac{(3 - 2x.0482)(.0507x1 - 1)}{2(2 - .0482)} \right] D = -Q_C$$

$$1.78C - .21D = -Q_C$$

$$\left[1 + 1.5x1 - \frac{(3 - 2x.0482)x1}{2(2 - .0482)} \right] D + \left[\frac{1}{2} - \frac{(3 - .0482)x1}{2(2 - .0482)} \right] C = -Q_D$$

$$1.76D - .26C = -Q_D$$

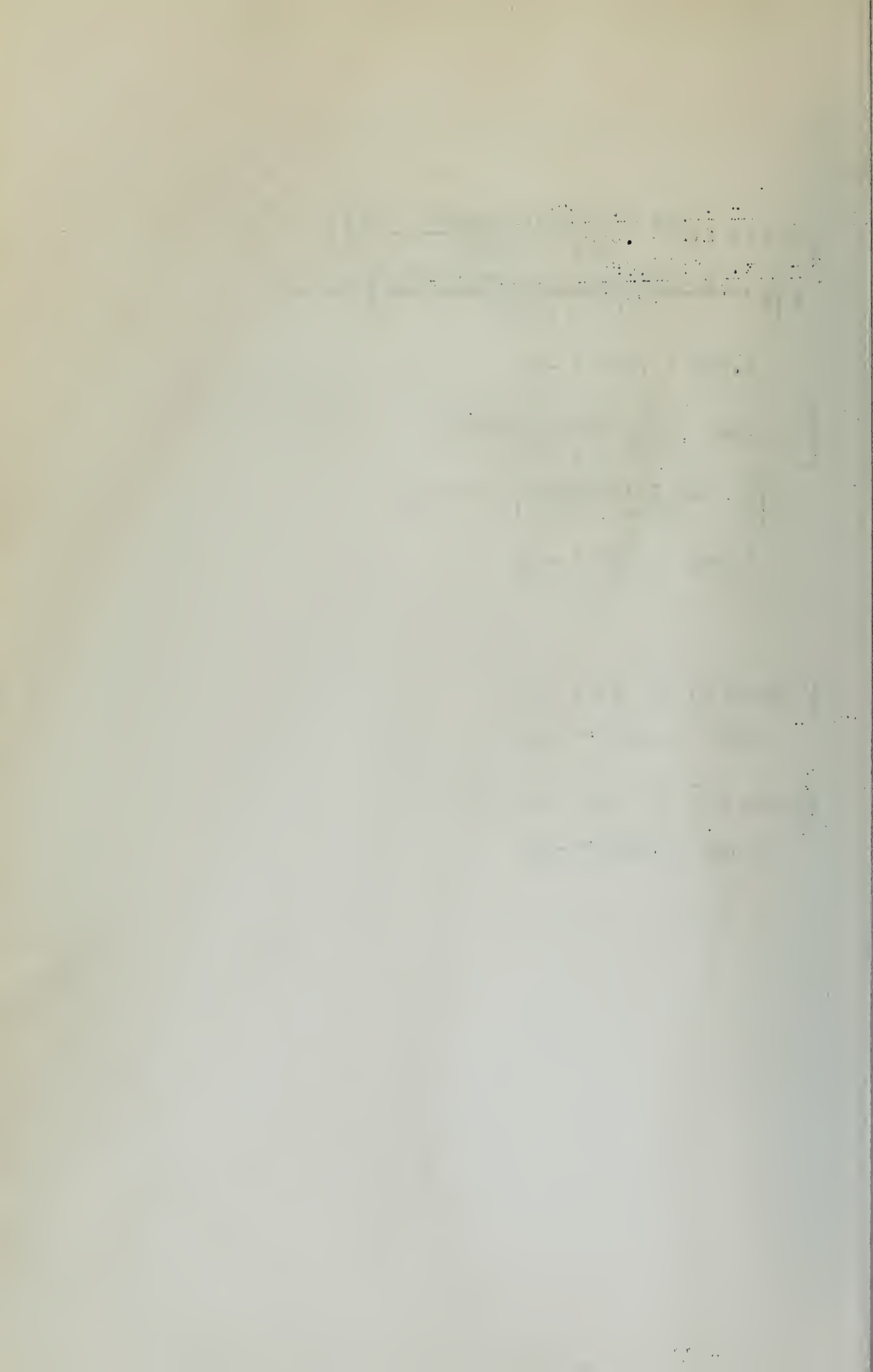
Panel 4

$$\left[1.5x1 + \frac{1}{4} \right] D - \frac{1}{4}E = -Q_D$$

$$1.75D - .25E = -Q_D$$

$$\left[1.5x1 + \frac{1}{4} \right] E - \frac{1}{4}D = -Q_E$$

$$1.75E - .25D = -Q_E$$



Joint Constant Computation - Load at B

Panel 1

$$1.82A - .17B = 5.77$$

$$-.26A + 1.76B = 6.28$$

$$A = 3.56 \quad B = 4.09$$

$$R_1 = \frac{2.91 \times 3.56 + 2.83 \times 4.09}{3.82} + 6.28 = 12.03$$

$$M_{FL} = (3.56 + \frac{4.09}{2} - 12.03) = -6.43$$

$$M_{BA} = (4.09 + \frac{3.56}{2} - 12.03) = -6.16$$

Panel 2

$$1.78B - .21C = -1.15$$

$$-.26B + 1.76C = -1.21$$

$$B = -.74 \quad C = -.80$$

$$R_2 = \frac{-2.96 \times .74 - 2.91 \times .80}{3.92} - 1.21 = -2.36$$

$$M_{BC} = (-.74 - \frac{.80}{2} + 2.36) = 1.22$$

$$M_{CB} = (-.80 - \frac{.74}{2} + 2.36) = 1.19$$

Panel 3

$$1.78C - .21D = -1.13$$

$$-.26C + 1.76D = -1.19$$

$$C = -.73 \quad D = -.78$$

$$R_3 = \frac{-2.95 \times .73 - 2.90 \times .78}{3.90} - 1.19 = -2.33$$

$$M_{CD} = (-.73 - \frac{.78}{2} + 2.33) = 1.21$$

$$M_{DC} = (-.78 - \frac{.73}{2} + 2.33) = 1.19$$

Panel 4

$$1.75D - .25E = -.94$$

$$-.25D + 1.75E = -.94$$

$$D = -.63 \quad E = -.63$$

$$R_4 = \frac{3}{4}(-.63 - .63) - .94 = -1.88$$

$$M_{DE} = (-.63 - \frac{.63}{2} + 1.88) = .94$$

$$M_{ED} = (-.63 - \frac{.63}{2} + 1.88) = .94$$

Panel 5

$$1.75E - .25F = -0.94$$

$$-.25E + 1.75F = -0.94$$

$$E = -0.63 \quad F = -0.63$$

$$R_5 = 3/4(-0.63 - 0.63) - 0.94 = -1.88$$

$$M_{EF} = 1(-0.63 - \frac{1}{2} \times 0.63 + 1.88) = .94$$

$$M_{FE} = 1(-0.63 - \frac{1}{2} \times 0.63 + 1.88) = .94$$

Panel 6

$$1.76F - .26G = -0.82$$

$$-.21F + 1.78G = -0.78$$

$$F = -0.54 \quad G = -0.50$$

$$R_6 = \frac{-2.90 \times .54 - 2.95 \times .50}{3.90} - .82 = -1.60$$

$$M_{FG} = 1(-0.54 - \frac{1}{2} \times 0.50 + 1.60) = 0.81$$

$$M_{GF} = 1(-0.50 - \frac{1}{2} \times 0.54 + 1.60) = 0.83$$

Panel 7

$$1.76G - .26H = -0.87$$

$$-.20G + 1.78H = -0.83$$

$$G = -0.57 \quad H = -0.53$$

$$R_7 = \frac{-2.91 \times .57 - 2.96 \times 0.53}{3.91} - 0.87 = 1.70$$

$$M_{GH} = 1(-0.57 - \frac{1}{2} \times 0.53 + 1.70) = .87$$

$$M_{HG} = 1(-0.53 - \frac{1}{2} \times 0.57 + 1.70) = .89$$

Panel 8

$$1.76H - .26I = -0.90$$

$$-.17H + 1.92I = -0.81$$

$$H = -0.59 \quad I = -0.50$$

$$R_8 = \frac{-2.83 \times .59 - 2.91 \times .50}{3.83} - 0.90 = -1.71$$

$$M_{HI} = 1(-0.59 - \frac{1}{2} \times 0.50 + 1.71) = 0.87$$

$$M_{IH} = 1(-0.50 - \frac{1}{2} \times 0.59 + 1.71) = 0.93$$

London, September 18, 1891

My dear Mr. Brewster

I have just received your letter of the 17th

and am glad to hear

from you and that you are well

and happy

I am very glad to hear that you are well

and that you are enjoying your trip

very much

I am

Very truly

Yours, W. Brewster

W. Brewster

W. Brewster

W. Brewster

W. Brewster

W. Brewster

W. Brewster

W. Brewster

W. Brewster

W. Brewster

Panel 5

$$1.75E - .25F = -0.94$$

$$-.25E + 1.75F = -0.94$$

$$E = -0.63 \quad F = -0.63$$

$$R_5 = 3/4(-0.63 - 0.63) - 0.94 = -1.88$$

$$M_{EF} = 1(-0.63 - \frac{1}{2} \times 0.63 + 1.88) = .94$$

$$M_{FE} = 1(-0.63 - \frac{1}{2} \times 0.63 + 1.88) = .94$$

Panel 6

$$1.76F - .26G = -0.82$$

$$-.21F + 1.78G = -0.78$$

$$F = -0.54 \quad G = -0.50$$

$$R_6 = \frac{-2.90 \times .54 - 2.95 \times .50}{3.90} - .82 = -1.60$$

$$M_{FG} = 1(-0.54 - \frac{1}{2} \times 0.50 + 1.60) = 0.81$$

$$M_{GF} = 1(-0.50 - \frac{1}{2} \times 0.54 + 1.60) = 0.83$$

Panel 7

$$1.76G - .26H = -0.87$$

$$-.20G + 1.78H = -0.83$$

$$G = -0.57 \quad H = -0.53$$

$$R_7 = \frac{-2.91 \times .57 - 2.96 \times 0.53}{3.91} - 0.87 = 1.70$$

$$M_{GH} = 1(-0.57 - \frac{1}{2} \times 0.53 + 1.70) = .87$$

$$M_{HG} = 1(-0.53 - \frac{1}{2} \times 0.57 + 1.70) = .89$$

Panel 8

$$1.76H - .26I = -0.90$$

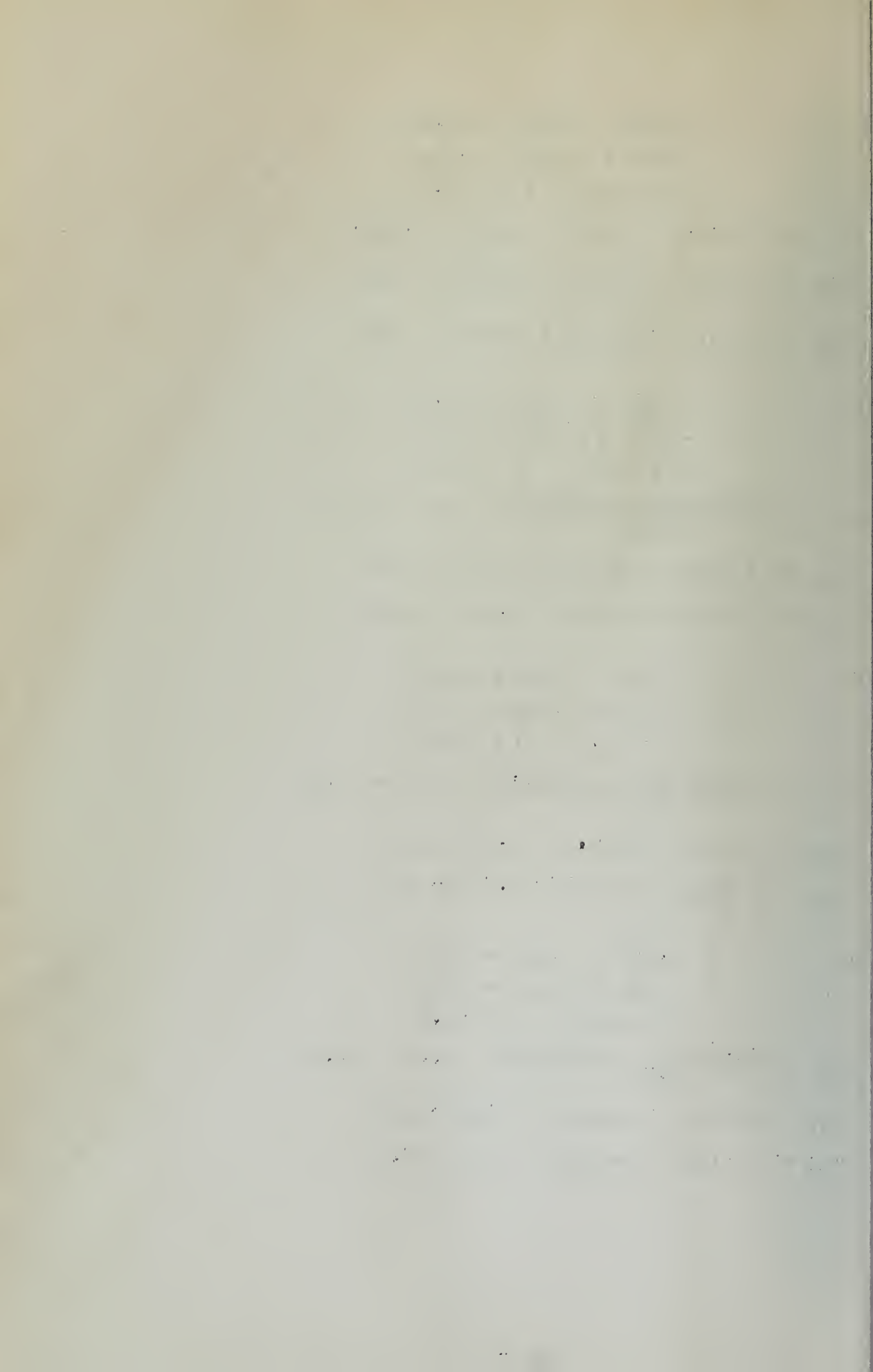
$$-.17H + 1.82I = -0.81$$

$$H = -0.59 \quad I = -0.50$$

$$R_8 = \frac{-2.83 \times .59 - 2.91 \times .50}{3.83} - 0.90 = -1.71$$

$$M_{HI} = 1(-0.59 - \frac{1}{2} \times 0.50 + 1.71) = 0.87$$

$$M_{IH} = 1(-0.50 - \frac{1}{2} \times 0.59 + 1.71) = 0.93$$



Joint Constant Computations - Load at C

Panel 1

$$1.82A - .17B = 4.89$$

$$-.26A + 1.76B = 5.38$$

$$A = 3.01 \quad B = 3.50$$

$$R_1 = \frac{2.91 \times 3.01 + 2.83 \times 3.50}{3.82} + 5.38 = 10.27$$

$$M_{AB} = (3.01 + \frac{3.50}{2} - 10.27) = -5.51$$

$$M_{BA} = (3.50 + \frac{3.01}{2} - 10.27) = -5.27$$

Panel 2

$$1.78B - .21C = 4.96$$

$$-.26B + 1.76C = 5.23$$

$$B = 3.20 \quad C = 3.44$$

$$R_2 = \frac{2.96 \times 3.20 + 2.91 \times 3.44}{3.92} + 5.23 = 10.21$$

$$M_{BC} = (3.20 + \frac{3.44}{2} - 10.21) = -5.29$$

$$M_{CB} = (3.44 + \frac{3.20}{2} - 10.21) = -5.17$$

Panel 3

$$1.78C - .21D = -2.36$$

$$-.26C + 1.76D = -2.38$$

$$C = -1.51 \quad D = -1.58$$

$$R_3 = \frac{-2.95 \times 1.51 - 2.90 \times 1.58}{3.90} - 2.38 = -4.70$$

$$M_{CD} = (-1.51 - \frac{1.58}{2} + 4.70) = 2.40$$

$$M_{DC} = (-1.58 - \frac{1.51}{2} + 4.70) = 2.37$$

Panel 4

$$1.75D - .25E = -1.87$$

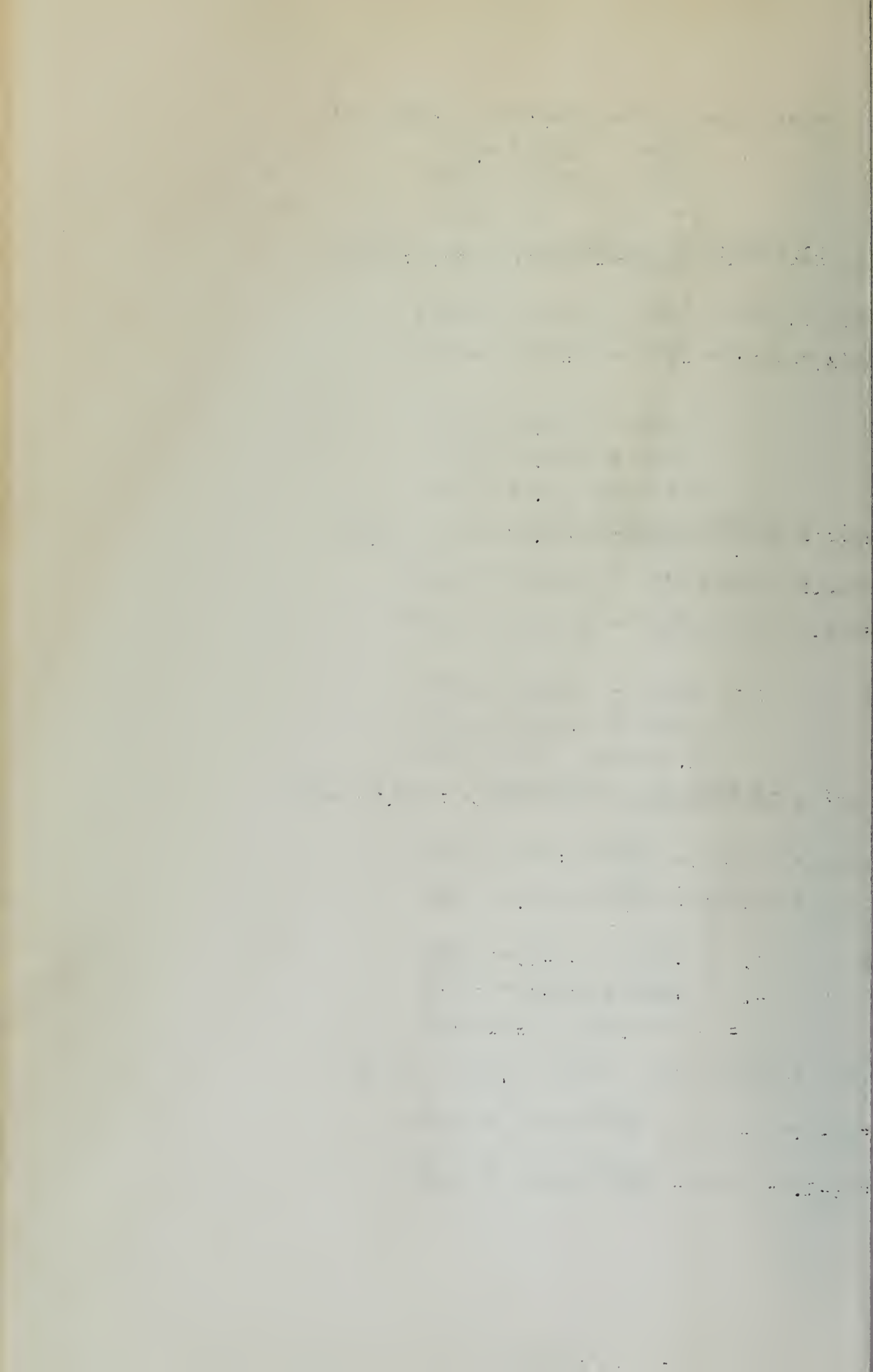
$$-.26D + 1.75E = -1.87$$

$$D = -1.25 \quad E = -1.25$$

$$R_4 = 3/4(-1.25 - 1.25) - 1.87 = -3.74$$

$$M_{DE} = (-1.25 - \frac{1.25}{2} + 3.74) = 1.87$$

$$M_{ED} = (-1.25 - \frac{1.25}{2} + 3.74) = 1.87$$



Panel 5

$$E = -1.26$$

$$F = -1.26$$

$$R_5 = -3.76$$

$$M_{EF} = 1.88$$

$$M_{FE} = 1.88$$

Panel 6

$$F = -1.08$$

$$G = -1.00$$

$$R_6 = -3.20$$

$$M_{FG} = 1.62$$

$$M_{GF} = 1.66$$

Panel 7

$$G = -1.14$$

$$H = -1.06$$

$$R_7 = -3.40$$

$$M_{GH} = 1.74$$

$$M_{HG} = 1.78$$

Panel 8

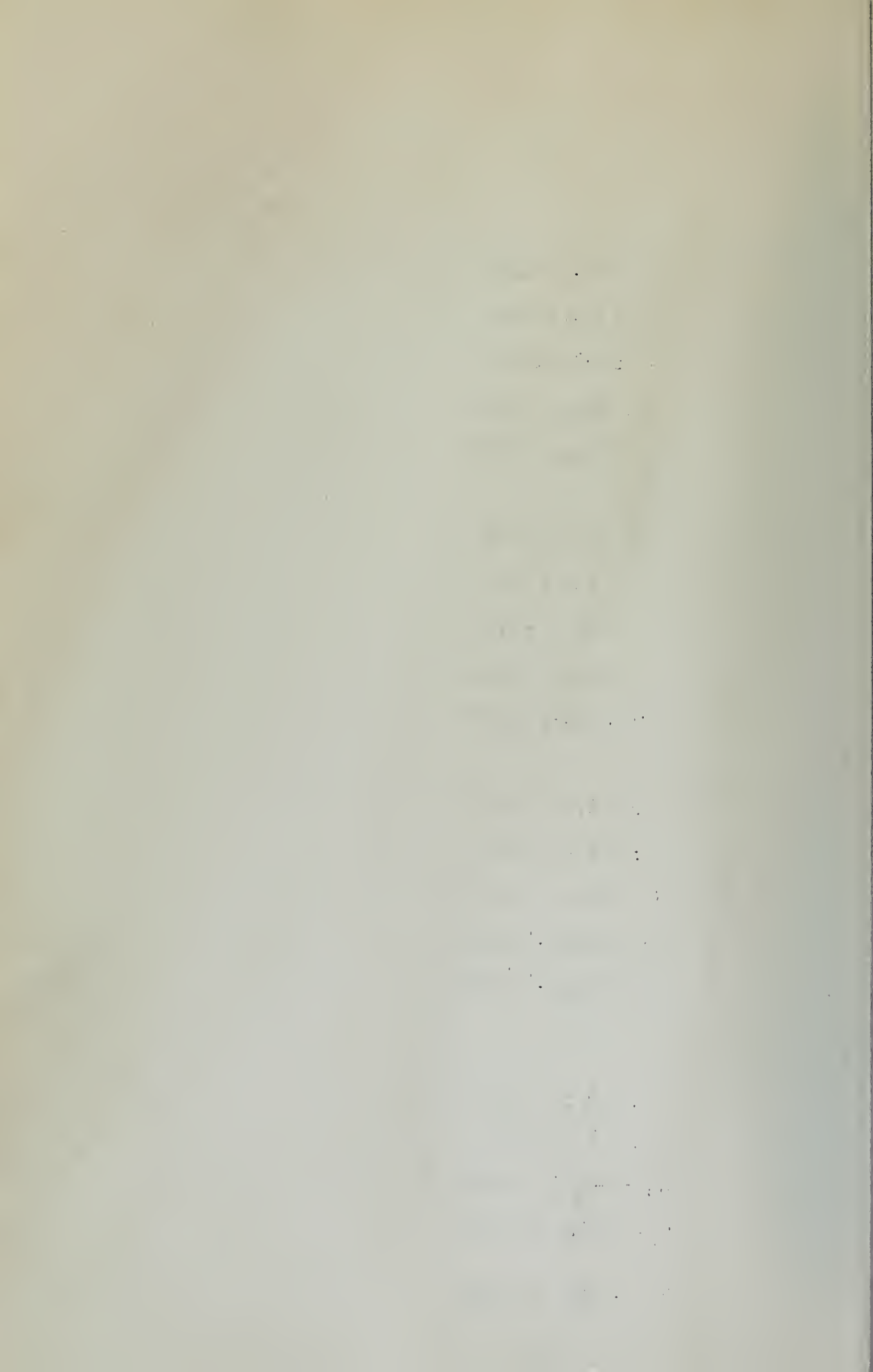
$$H = -1.18$$

$$I = -1.00$$

$$R_8 = -3.42$$

$$M_{HI} = 1.74$$

$$M_{IH} = 1.86$$



Joint Constant Computation-Load at D

Panel 1

$$\begin{aligned} 1.82A - .17B &= 4.12 \\ -.26A + 1.76B &= 4.49 \\ A &= 2.54 \quad B = 2.92 \end{aligned}$$

$$R_1 = \frac{2.91 \times 2.54 + 2.83 \times 2.92 + 4.49}{3.82} = 8.59$$

$$M_{AB} = (2.54 + \frac{2.92}{2} - 8.59) = -4.59$$

$$M_{BA} = (2.92 + \frac{2.54}{2} - 8.59) = -4.50$$

Panel 2

$$\begin{aligned} 1.78B - .21C &= 4.14 \\ -.26B + 1.76C &= 4.36 \end{aligned}$$

$$B = 2.67 \quad C = 2.87$$

$$R_2 = \frac{2.96 \times 2.67 + 2.91 \times 2.87 + 4.36}{3.92} = 8.51$$

$$M_{BC} = (2.67 + \frac{2.87}{2} - 8.51) = -4.41$$

$$M_{CB} = (2.87 + \frac{2.67}{2} - 8.51) = -4.31$$

Panel 3

$$\begin{aligned} 1.78C - .21D &= 3.91 \\ -.26C + 1.76D &= 4.12 \end{aligned}$$

$$C = 2.52 \quad D = 2.71$$

$$R_3 = \frac{2.95 \times 2.52 + 2.90 \times 2.71 + 4.12}{3.90} = 8.04$$

$$M_{CD} = (2.52 + \frac{2.71}{2} - 8.04) = -4.17$$

$$M_{DC} = (2.71 + \frac{2.52}{2} - 8.04) = -4.07$$

Panel 4

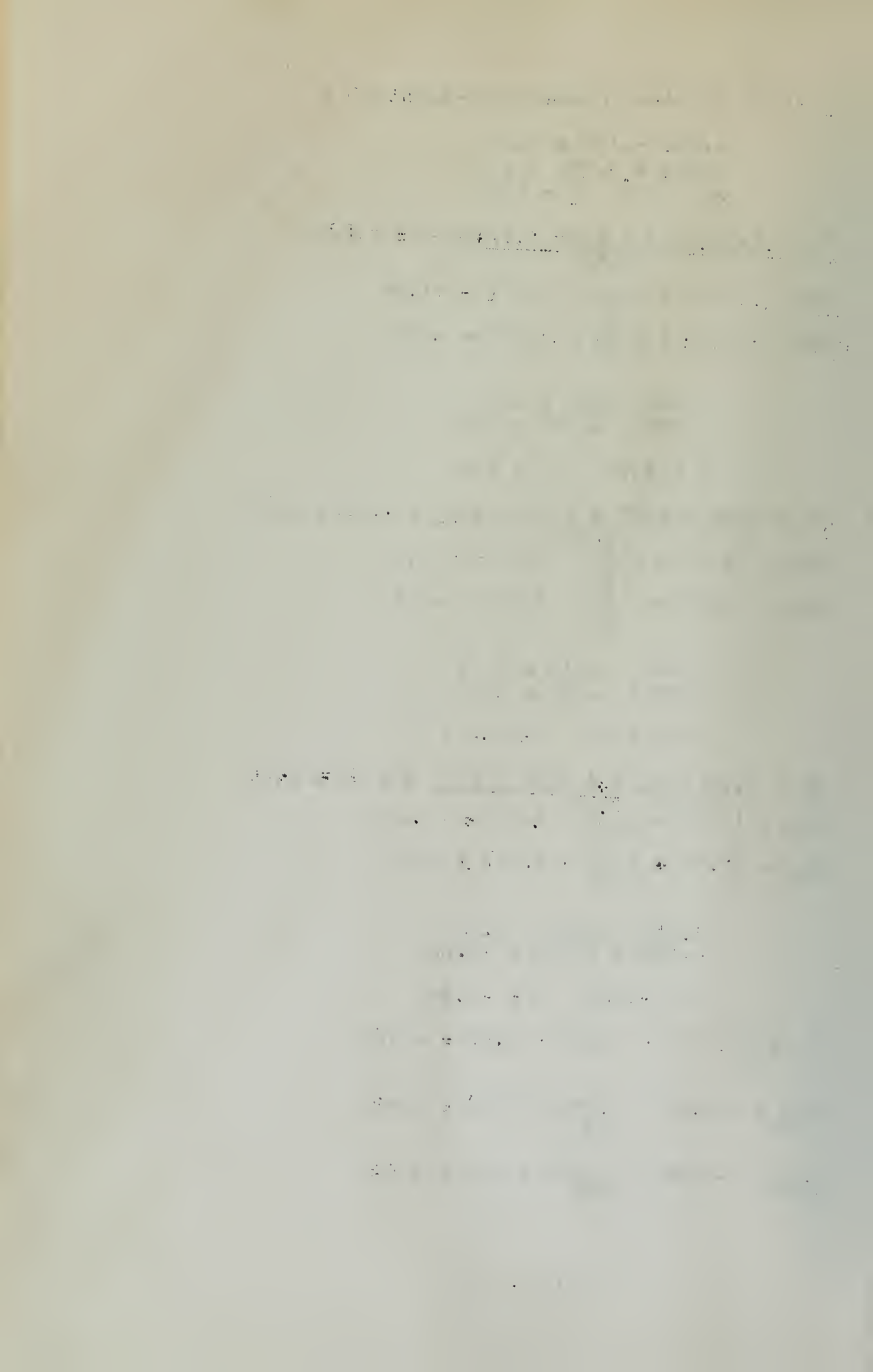
$$\begin{aligned} 1.75D - .25E &= -2.82 \\ -.25D + 1.75E &= -2.82 \end{aligned}$$

$$D = -1.88 \quad E = -1.88$$

$$R_4 = \frac{3(-1.88 - 1.88) - 2.82}{4} = -5.64$$

$$M_{DE} = (-1.88 - \frac{1.88}{2} + 5.64) = 2.82$$

$$M_{ED} = (-1.88 - \frac{1.88}{2} + 5.64) = 2.82$$



Panel 5

$$\begin{aligned}E &= -1.89 \\F &= -1.89 \\R_5 &= -5.64 \\M_{EF} &= 2.82 \\M_{FE} &= 2.82\end{aligned}$$

Panel 6

$$\begin{aligned}F &= -1.62 \\G &= -1.50 \\R_6 &= 4.80 \\M_{FG} &= 2.43 \\M_{GF} &= 2.49\end{aligned}$$

Panel 7

$$\begin{aligned}G &= -1.71 \\H &= -1.59 \\R_7 &= -5.10 \\M_{GH} &= 2.61 \\M_{HG} &= 2.67\end{aligned}$$

Panel 8

$$\begin{aligned}H &= -1.77 \\I &= -1.50 \\R_8 &= -5.13 \\M_{HI} &= 2.61 \\M_{IH} &= 2.79\end{aligned}$$

Joint Constant Computation - Load at E

Panel 1

$$1.82A - .17B = 3.26$$

$$.26A + 1.76B = 3.59$$

$$A = 2.01 \quad B = 2.34$$

$$R_1 = \frac{2.91 \times 2.01 + 2.83 \times 2.34}{3.82} + 3.59 = 6.86$$

$$M_{AB} = (2.01 + \frac{2.34}{2} - 6.86) = -3.68$$

$$M_{BA} = (2.34 + \frac{2.01}{2} - 6.86) = -3.52$$

Panel 2

$$1.78B - .21C = 3.31$$

$$.26B + 1.76C = 3.49$$

$$B = 2.13 \quad C = 2.30$$

$$R_2 = \frac{2.96 \times 2.13 + 2.91 \times 2.30}{3.92} + 3.49 = 6.81$$

$$M_{BC} = (2.13 + \frac{2.30}{2} - 6.81) = -3.53$$

$$M_{CB} = (2.30 + \frac{2.13}{2} - 6.81) = -3.45$$

Panel 3

$$1.78C - .21D = 3.13$$

$$.26C + 1.76D = 3.30$$

$$C = 2.01 \quad D = 2.17$$

$$R_3 = \frac{2.95 \times 2.01 + 2.90 \times 2.17}{3.90} + 3.30 = 6.44$$

$$M_{CD} = (2.01 + \frac{2.17}{2} - 6.44) = -3.35$$

$$M_{DC} = (2.17 + \frac{2.01}{2} - 6.44) = -3.27$$

Panel 4

$$1.75D - .25E = 3.75$$

$$.25D + 1.75E = 3.75$$

$$D = 2.50 \quad E = 2.50$$

$$R_4 = 3/4(2.50 + 2.50) + 3.75 = 7.50$$

$$M_{DE} = (2.50 + \frac{2.50}{2} - 7.50) = -3.75$$

$$M_{ED} = (2.50 + \frac{2.50}{2} - 7.50) = -3.75$$

Panel 5

$$E = -2.52$$

$$F = -2.52$$

$$R_5 = -7.52$$

$$M_{EF} = 3.76$$

$$M_{FE} = 3.76$$

Panel 6

$$E = -2.16$$

$$G = -2.00$$

$$E_5 = -6.40$$

$$M_{EG} = 3.24$$

$$M_{GE} = 3.24$$

Panel 7

$$G = -2.28$$

$$F = -2.12$$

$$R_7 = -6.80$$

$$M_{GH} = 3.48$$

$$M_{HG} = 3.56$$

Panel 8

$$H = -2.06$$

$$G = -2.00$$

$$R_8 = -6.80$$

$$M_{HI} = 3.48$$

$$M_{IH} = 3.72$$

Moment Corrections - Load at PPl

Panel 1

$$1.82A - .17B = 0$$

$$-.26A + 1.76B = -1.22$$

$$A = -.07 \quad B = -.69$$

$$R_1 = \frac{-2.91 \times .07 - 2.83 \times .69}{3.83} = -.54$$

$$M_{AB} = 1(-.07 - \frac{1}{2} \times .69 + .54) = .12$$

$$M_{BA} = 1(-.69 - \frac{1}{2} \times .07 + .54) = -.18$$

Panel 2

$$1.78B - .20C = 6.16$$

$$-.26B + 1.76C = -1.21$$

$$B = 3.44 \quad C = -.18$$

$$R_2 = \frac{2.96 \times 3.44 - 2.91 \times .18}{3.91} = 2.47$$

$$M_{BC} = 1(3.44 - \frac{1}{2} \times .18 - 2.47) = .88$$

$$M_{CB} = 1(-.18 + \frac{1}{2} \times 3.44 - 2.47) = -.93$$

Panel 3

$$1.78C - .21D = -1.19$$

$$-.26C + 1.76D = -.94$$

$$C = -.74 \quad D = -.64$$

$$R_3 = \frac{-2.95 \times .74 - 2.90 \times .64}{3.90} = -1.04$$

$$M_{CD} = 1(-.74 - \frac{1}{2} \times .64 + 1.04) = -.02$$

$$M_{DC} = 1(-.64 - \frac{1}{2} \times .74 + 1.04) = .03$$

Panel 4

$$1.75D - .25E = -1.19$$

$$-.25D + 1.75E = -.94$$

$$D = -.77 \quad E = -.64$$

$$R_4 = 3/4(-.77 - .64) = -1.06$$

$$M_{DE} = 1(-.77 - \frac{1}{2} \times .64 + 1.06) = -.03$$

$$M_{ED} = 1(-.64 - \frac{1}{2} \times .77 + 1.06) = .03$$

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Panel 5

$$\begin{aligned} 1.75E - .25F &= -.94 \\ -.25E + 1.75F &= -.81 \end{aligned}$$

$$E = -.61$$

$$\begin{aligned} F &= -.54 \\ R_5 &= \frac{3}{4} (-.61 - .54) = -.86 \\ M_{EF} &= 1(-.61 - \frac{1}{2} \times .54 + .86) = -.02 \\ M_{FE} &= 1(-.54 - \frac{1}{2} \times .61 + .86) = .02 \end{aligned}$$

Panel 6

$$\begin{aligned} 1.76F - .26G &= -.94 \\ -.21F + 1.78G &= -.93 \end{aligned}$$

$$F = -.62$$

$$\begin{aligned} G &= -.56 \\ R_6 &= \frac{-2.90 \times .62 - 2.95 \times .56}{3.90} = -.88 \\ M_{FG} &= 1(-.62 - \frac{1}{2} \times .56 + .88) = 0 \\ M_{GF} &= 1(-.56 - \frac{1}{2} \times .62 + .88) = 0 \end{aligned}$$

Panel 7

$$\begin{aligned} 1.76G - .26H &= -.83 \\ -.20G + 1.78H &= -.87 \end{aligned}$$

$$G = -.55$$

$$H = -.55$$

$$\begin{aligned} R_7 &= \frac{-2.91 \times .55 - 2.96 \times .55}{3.91} = -.83 \\ M_{GH} &= 1(-.55 - \frac{1}{2} \times .55 + .83) = 0 \\ M_{HG} &= 1(-.55 - \frac{1}{2} \times .55 + .83) = 0 \end{aligned}$$

Panel 8

$$\begin{aligned} 1.76H - .26I &= -.89 \\ -.17H + 1.82I &= 0 \end{aligned}$$

$$H = -.51$$

$$I = -.05$$

$$\begin{aligned} R_8 &= \frac{-2.83 \times .51 - 2.91 \times .05}{3.83} = -.41 \\ M_{HI} &= 1(-.51 - \frac{1}{2} \times .05 + .42) = -.11 \\ M_{IH} &= 1(-.05 - \frac{1}{2} \times .51 + .42) = .11 \end{aligned}$$

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1. The first group of people who are interested in the study of the history of the world are the historians. They are people who study the past and try to understand what happened and why it happened. They use a variety of sources, including books, documents, and artifacts, to reconstruct the past. They also try to understand the people who lived in the past and how they thought and felt. Historians are interested in the history of the world because it helps them to understand the present and the future.

1. The first part of the paper is devoted to a review of the literature on the topic of the role of the state in the development of the economy. It is found that the state has played a significant role in the development of the economy in many countries, particularly in the case of developing countries. The state has been able to mobilize resources, provide infrastructure, and create a favorable environment for investment and growth.

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Journal of Management Studies, 19(6), 701-718.

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Panel 1

$$1.82A - .17B = 0$$

$$-.26A + 1.76 = -.88$$

$$A = -.04$$

$$B = -.49$$

$$R_1 = \frac{-2.91 \times .04 - 2.83 \times .49}{3.83} = -.40$$

$$M_{AB} = (.04 - \frac{1}{2} \times .49 + .40) = .11$$

$$M_{BA} = (.49 - \frac{1}{2} \times .04 + .40) = -.11$$

Panel 3

$$1.78C - .21D = .93$$

$$-.26C + 1.76D = .03$$

$$C = .59$$

$$D = .10$$

$$R_3 = \frac{2.95 \times .59 - 2.90 \times .10}{3.90} = .52$$

$$M_{CD} = 1(.59 + \frac{1}{2} \times .10 - .52) = .12$$

$$M_{DC} = 1(.10 + \frac{1}{2} \times .59 - .52) = -.12$$

Load at B

| nel | 1 | | 2 | | 3 | | 4 | |
|------|-------|-------|-------|-------|-------|-------|-------|------|
| | A | B | B | C | C | D | D | E |
| Q | 5.77 | 6.28 | -1.15 | -1.21 | -1.13 | -1.19 | -.94 | -.94 |
| Y | 3.56 | 4.09 | -.74 | -.80 | -.73 | -.78 | -.63 | -.63 |
| R | 2.03 | | -2.36 | | -2.33 | | -1.88 | |
| M' | -6.43 | -6.16 | 1.22 | 1.19 | 1.21 | 1.19 | 0.94 | 0.94 |
| Q | 0 | -1.22 | 6.16 | -1.21 | -1.19 | -.94 | -1.19 | -.94 |
| Y | -.07 | -.69 | 3.44 | -.18 | -.74 | -.64 | -.77 | -.64 |
| R | -.54 | | 2.47 | | -1.04 | | -1.06 | |
| M'' | .12 | -.18 | .88 | -.93 | -.02 | .03 | -.03 | .03 |
| Q | 0 | -.88 | | | -.93 | .03 | | |
| Y | -.04 | -.49 | | | .59 | .10 | | |
| R | -.40 | | | | .52 | | | |
| M''' | .11 | -.11 | 0 | 0 | .12 | -.12 | 0 | 0 |
| M | -6.20 | -6.45 | 2.10 | .26 | 1.31 | 1.10 | .91 | .97 |

| Inel | 5 | | 6 | | 7 | | 8 | |
|------|-------|------|-------|------|-------|------|-------|------|
| | E | F | F | G | G | H | H | I |
| Q | -.94 | -.94 | -.82 | -.78 | -.87 | -.83 | -.90 | -.81 |
| | -.63 | -.63 | -.54 | -.50 | -.57 | -.53 | -.59 | -.50 |
| R | -1.88 | | -1.60 | | -1.70 | | -1.71 | |
| M' | .94 | .94 | .81 | .83 | .87 | .89 | .87 | .93 |
| Q | -.94 | -.81 | -.94 | -.87 | -.83 | -.87 | -.89 | 0 |
| | -.61 | -.54 | -.62 | -.56 | -.55 | -.55 | -.51 | -.05 |
| R | -.86 | | -.88 | | -.83 | | -.41 | |
| M'' | -.02 | .02 | 0 | 0 | 0 | 0 | -.11 | .11 |
| Q | | | | | | | | |
| R | | | | | | | | |
| M''' | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| M | .92 | .96 | .81 | .83 | .87 | .89 | .76 | 1.04 |

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Moment Corrections Load at C

Panel 1

$$1.82A - .17B = 0$$

$$-.26A + 1.76B = 5.29$$

$$A = .29$$

$$B = 3.04$$

$$R_1 = \frac{2.91 \times .29 + 2.83 \times 3.04}{3.83} = 2.46$$

$$M_{AB} = 1(.29 + \frac{1}{2} \times 3.04 - 2.46) = -.65$$

$$M_{BC} = 1(3.04 + \frac{1}{2} \times .29 - 2.46) = .72$$

Panel 2

$$1.78B - .20C = 5.27$$

$$-.26B + 1.76 C = -2.40$$

$$B = 2.85$$

$$C = -.94$$

$$R_2 = \frac{2.96 \times 2.85 - 2.91 \times .94}{3.91} = 1.46$$

$$M_{BC} = 1(2.85 - \frac{1}{2} \times .94 - 1.46) = .92$$

$$M_{CB} = 1(-.94 + \frac{1}{2} \times 2.85 - 1.46) = -.98$$

Panel 3

$$1.78C - .21D = 5.17$$

$$-.26C + 1.76D = -1.87$$

$$C = 2.82$$

$$D = -.65$$

$$R_3 = \frac{2.95 \times 2.82 - 2.90 \times .65}{3.90} = 1.65$$

$$M_{CD} = 1(2.82 - \frac{1}{2} \times .65 - 1.65) = .85$$

$$M_{DC} = 1(-.65 + \frac{1}{2} \times 2.82 - 1.65) = -.89$$

Let V be a vector space over F .

Let T be a linear transformation on V .

Let λ be an eigenvalue of T .

Let v be an eigenvector of T .

Then $Tv = \lambda v$.

Let W be the subspace of V consisting of all eigenvectors of T corresponding to λ .

Then W is a subspace of V .

Let U be the subspace of V consisting of all vectors u such that $Tu = \lambda u$.

Then U is a subspace of V .

Let $W = U$.

Then $W = U$.

Let W be the subspace of V consisting of all eigenvectors of T corresponding to λ .

Then W is a subspace of V .

Let U be the subspace of V consisting of all vectors u such that $Tu = \lambda u$.

Then U is a subspace of V .

Let $W = U$.

Then $W = U$.

Let W be the subspace of V consisting of all eigenvectors of T corresponding to λ .

Then W is a subspace of V .

Let U be the subspace of V consisting of all vectors u such that $Tu = \lambda u$.

nel 4

$$1.75D - .25E = -2.37$$

$$-.25D + 1.75E = -1.88$$

$$D = -1.54$$

$$E = -1.30$$

$$R_4 = \frac{3}{4} (-1.54 - 1.30) = -2.13$$

$$M_{DE} = 1(-1.54 - \frac{1}{2} \times 1.30 + 2.13) = -.06$$

$$M_{ED} = 1(-1.30 - \frac{1}{2} \times 1.54 + 2.13) = .06$$

anel 5

$$1.75 - .25F = -1.87$$

$$-.25E + 1.75F = -1.62$$

$$E = -1.23$$

$$F = -1.10$$

$$R_5 = \frac{3}{4} (-1.23 - 1.10) = -1.75$$

$$M_{EF} = 1(-1.23 - \frac{1}{2} \times 1.10 + 1.75) = -.03$$

$$M_{FE} = 1(-1.10 - \frac{1}{2} \times -1.23 + 1.75) = .03$$

anel 6

$$1.76F - .26G = -1.88$$

$$-.21F + 1.78G = -1.74$$

$$F = -1.22$$

$$G = -1.12$$

$$R_6 = \frac{-2.90 \times 1.22 - 2.95 \times 1.12}{3.90} = -1.75$$

$$M_{FG} = 1(-1.22 - \frac{1}{2} \times 1.12 + 1.75) = -.03$$

$$M_{GF} = 1(-1.12 - \frac{1}{2} \times 1.22 + 1.75) = .02$$

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Journal of Management Studies, 19(1), 67-80.

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Panel 7

$$1.76G - .26H = -1.66$$

$$-.20G + 1.78H = -1.74$$

$$G = -1.10$$

$$H = -1.10$$

$$R_7 = \frac{-2.91 \times 1.10 - 2.96 \times 1.10}{3.91} = -1.65$$

$$M_{GH} = 1(-1.10 - \frac{1}{2} \times 1.10 + 1.65) = 0$$

$$M_{HG} = 1(-1.10 - \frac{1}{2} \times 1.10 + 1.65) = 0$$

Panel 8

$$1.76H - .26I = -1.78$$

$$-.17H + 1.82I = 0$$

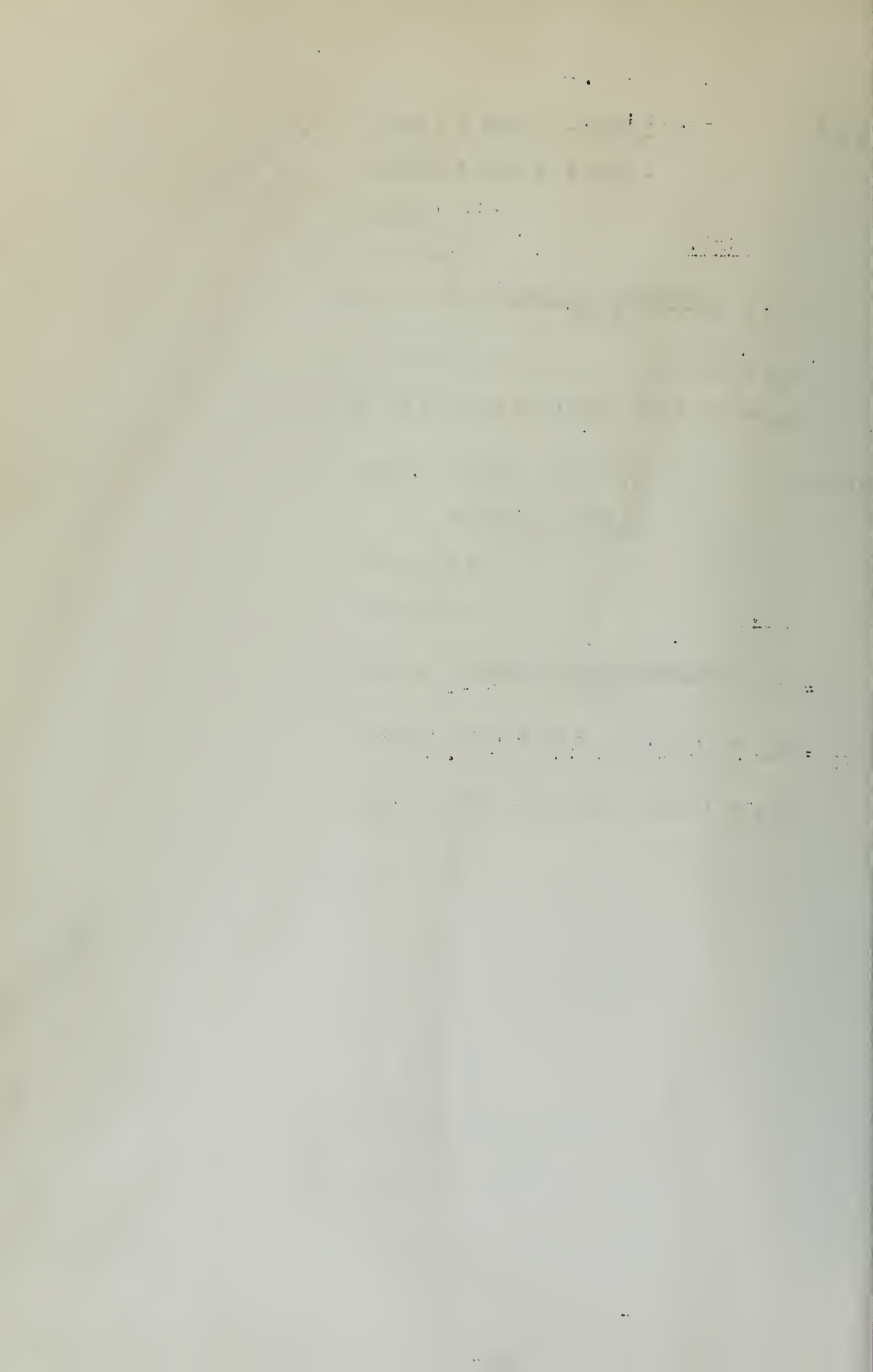
$$H = -1.02$$

$$I = -0.10$$

$$R_8 = \frac{-2.83 \times 1.02 - 2.91 \times .10}{3.83} = -.83$$

$$M_{HI} = 1(-1.02 - \frac{1}{2} \times .10 + .83) = -.24$$

$$M_{IH} = 1(-.10 - \frac{1}{2} \times 1.02 + .83) = .22$$



$$\begin{aligned}\text{Panel 1} \quad & 1.82A - .17B = 0 \\ & -.26A + 1.76B = -.92 \\ & A = -.05 \quad B = -.53\end{aligned}$$

$$R_1 = \frac{-2.91 \times .05 - 2.83 \times .53}{3.83} = -.43$$

$$M_{AB} = 1(-.05 - \frac{1}{2} \times .53 + .43) = .11$$

$$M_{BA} = 1(-.53 - \frac{1}{2} \times .05 + .43) = -.11$$

$$\begin{aligned}\text{Panel 2} \quad & 1.78B + .20C = .72 \\ & -.26B + 1.76C = -.85 \\ & B = -.46 \quad C = -.55\end{aligned}$$

$$R_2 = \frac{-2.96 \times .46 - 2.91 \times .55}{3.91} = -.76$$

$$M_{BC} = 1(-.46 - \frac{1}{2} \times .55 + .76) = .02$$

$$M_{CB} = 1(-.55 - \frac{1}{2} \times .46 + .76) = -.02$$

$$\begin{aligned}\text{Panel 3} \quad & 1.78C - .21D = .98 \\ & -.26C + 1.76D = .06 \\ & C = .56 \quad D = .12\end{aligned}$$

$$R_3 = \frac{2.95 \times .56 + 2.90 \times .12}{3.90} = .57$$

$$M_{CD} = 1(.56 + \frac{1}{2} \times .12 - .51) = .11$$

$$M_{DC} = 1(.12 + \frac{1}{2} \times .56 - .51) = -.11$$

$$\begin{aligned}\text{Panel 4} \quad & 1.75D - .25E = .89 \\ & -.25D + 1.75E = .03 \\ & D = .52 \quad E = .09\end{aligned}$$

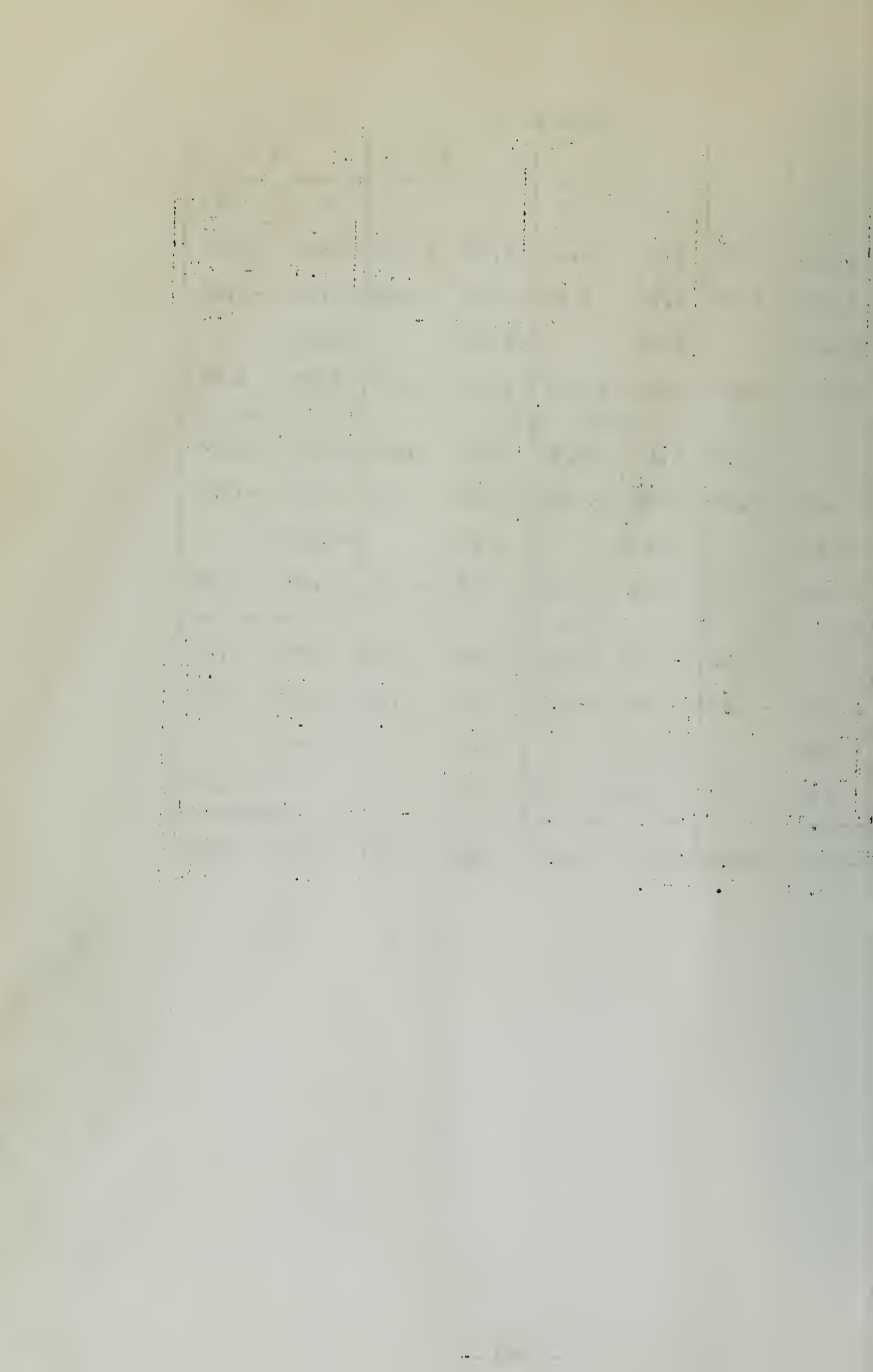
$$R_4 = 3/4(.52 + .09) = .46$$

$$M_{DE} = 1(.52 + \frac{1}{2} \times .09 - .46) = .11$$

$$M_{ED} = 1(.09 + \frac{1}{2} \times .52 - .46) = -.11$$

Load at C

| Panel | 1 | | 2 | | 3 | | 4 | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Joint | A | B | B | C | C | D | D | E |
| Q | 4.89 | 5.38 | 4.96 | 5.23 | -2.36 | -2.38 | -1.87 | -1.87 |
| x | 3.01 | 3.50 | 3.20 | 3.44 | -1.51 | -1.58 | -1.25 | -1.25 |
| R | 10.27 | | 10.21 | | -4.70 | | -3.74 | |
| M' | -5.41 | -5.27 | -5.29 | -5.17 | 2.40 | 2.37 | 1.87 | 1.87 |
| Q | 0 | 5.29 | 5.27 | -2.40 | 5.17 | -1.87 | -2.37 | -1.88 |
| x | .29 | 3.04 | 2.85 | -.94 | 2.82 | -.65 | -1.54 | -1.30 |
| R | 2.46 | | 1.46 | | 1.65 | | -2.13 | |
| M' | -.65 | .72 | .92 | -.98 | .85 | -.89 | -.06 | .06 |
| Q | 0 | -.92 | -.72 | -.85 | .98 | .06 | .89 | .03 |
| x | -.05 | -.53 | -.46 | -.55 | .56 | .12 | .52 | .09 |
| R | -.43 | | -.76 | | .51 | | .46 | |
| M'' | .11 | -.11 | .02 | -.02 | .11 | -.11 | .11 | -.11 |
| M | -6.05 | -4.65 | -4.35 | -6.17 | 3.36 | 1.37 | 1.92 | 1.82 |



| 5 | | 6 | | 7 | | 8 | |
|-------|-------|-------|-------|-------|-------|-------|-------|
| L | F | F | G | G | H | H | I |
| -1.88 | -1.88 | -1.64 | -1.56 | -1.74 | -1.66 | -1.80 | -1.62 |
| -1.26 | -1.26 | -1.08 | -1.00 | -1.14 | -1.06 | -1.18 | -1.10 |
| -3.76 | | -3.20 | | -3.40 | | -3.42 | |
| 1.88 | 1.88 | 1.62 | 1.66 | 1.74 | 1.78 | 1.74 | 1.86 |
| -1.87 | -1.62 | -1.88 | -1.74 | -1.66 | -1.74 | -1.78 | 0 |
| -1.23 | -1.10 | -1.22 | -1.12 | -1.10 | -1.10 | -1.02 | - .10 |
| -1.75 | | -1.75 | | -1.65 | | - .83 | |
| - .03 | .03 | - .03 | .02 | 0 | 0 | - .24 | .22 |
| - .06 | .03 | - .03 | 0 | - .02 | .24 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1.85 | 1.91 | 1.59 | 1.68 | 1.74 | 1.78 | 1.50 | 2.08 |

Influence Line Corrections - First Set

Panel 1

Load at D

$$1.82A - .17B = 0$$

$$-.26A + 1.76B = 4.41$$

$$A = .24$$

$$B = 2.54$$

$$R_1 = 2.06$$

$$M_{AB} = (.24 + \frac{2.54}{2} - 2.06) = -.57$$

$$M_{BA} = (2.54 + \frac{.24}{2} - 2.06) = -.59$$

Panel 2

$$1.78B - .21C = 4.40$$

$$-.26B + 1.76C = 4.17$$

$$B = 2.80$$

$$C = 2.78$$

$$R_2 = 4.18$$

$$M_{BC} = (2.80 + \frac{2.78}{2} - 4.18) = 0$$

$$M_{CB} = (2.78 + \frac{2.80}{2} - 4.18) = 0$$

Panel 3

$$1.78C - .21D = 4.31$$

$$-.26C + 1.76D = -2.82$$

$$C = 2.27$$

$$D = -1.27$$

$$R_3 = .78$$

$$M_{CD} = (2.27 - \frac{1.27}{2} - .78) = .86$$

$$M_{DC} = (-1.27 + \frac{2.27}{2} - .78) = -.92$$

Panel 4

$$1.75D - .25E = 4.07$$

$$-.25D + 1.75E = -2.82$$

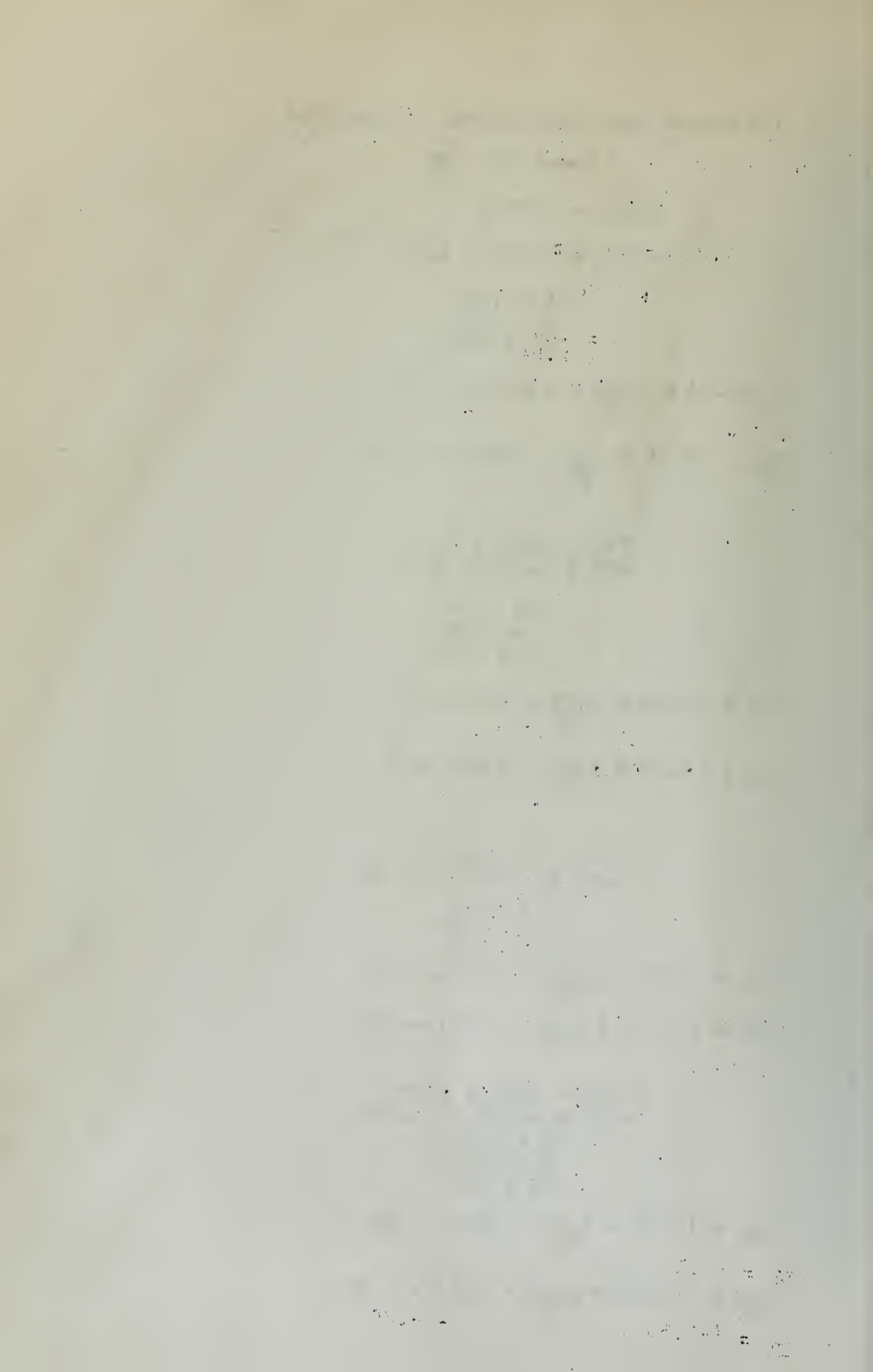
$$D = 2.14$$

$$E = -1.30$$

$$R_4 = .63$$

$$M_{DE} = (2.14 - \frac{1.30}{2} - .63) = .86$$

$$M_{ED} = (-1.30 + \frac{2.14}{2} - .63) = -.86$$



anel 5

$$\begin{aligned}-.25F + 1.75E &= -2.82 \\ 1.75F - .25E &= -2.43\end{aligned}$$

$$\begin{aligned}E &= -1.85 \\ F &= -1.65 \\ R_5 &= -2.63\end{aligned}$$

$$M_{EF} = (-1.85 - \frac{1.65}{2} + 2.63) = -.04$$

$$M_{FE} = (-1.65 - 1.85 + 2.63) = .06$$

anel 6

$$\begin{aligned}-.26G + 1.76F &= -2.82 \\ 1.78G - .21F &= -2.61\end{aligned}$$

$$\begin{aligned}F &= -1.85 \\ G &= -1.69 \\ R_6 &= -2.66\end{aligned}$$

$$M_{FG} = (-1.85 - \frac{1.69}{2} + 2.66) = -.03$$

$$M_{GF} = (-1.69 - \frac{1.85}{2} + 2.66) = .05$$

anel 7

$$\begin{aligned}-.26H + 1.76G &= -2.49 \\ 1.78H - .21G &= -2.61\end{aligned}$$

$$\begin{aligned}G &= -1.66 \\ H &= -1.66 \\ R_7 &= -2.49\end{aligned}$$

$$M_{GH} = (-1.66 - \frac{1.66}{2} + 2.49) = 0$$

$$M_{HG} = (-1.66 - \frac{1.66}{2} + 2.49) = 0$$

anel 8

$$\begin{aligned}-.26I + 1.76H &= -2.67 \\ 1.82I - .17H &= 0\end{aligned}$$

$$\begin{aligned}H &= -1.54 \\ I &= -.14 \\ R_8 &= -1.25\end{aligned}$$

$$M_{HI} = (-1.54 - \frac{.14}{2} + 1.25) = -.36$$

$$M_{IH} = (-.14 - \frac{1.54}{2} + 1.25) = .34$$

Influence Line Corrections-Load at D

Second Set

nel 1 0

nel 2

$$1.78B - .21C = .59$$

$$-.26B + 1.76C = -.86$$

$$B = -.40$$

$$C = -.55$$

$$R_2 = -.71$$

$$M_{BC} = (-.40 - \frac{.55}{2} + .71) = .04$$

$$M_{CB} = (-.55 - \frac{.40}{2} + .71) = -.04$$

nel 3

$$1.78C - .21D = 0$$

$$-.26C + 1.76D = -.86$$

$$C = -.06$$

$$D = -.50$$

$$R_3 = -.42$$

$$M_{CD} = (-.06 - \frac{.50}{2} + .42) = .11$$

$$M_{DC} = (-.50 - \frac{.06}{2} + .42) = -.11$$

nel 4

$$1.75D - .25E = .92$$

$$-.25D + 1.75E = .04$$

$$D = .54$$

$$E = .10$$

$$R_4 = .43$$

$$M_{DE} = (.54 + \frac{.10}{2} - .43) = .11$$

$$M_{ED} = (.10 + .54 - .43) = .11$$

Panel 5

$$-.25F + 1.75E = .86$$

$$1.75F - .25E = .03$$

$$E = .50$$

$$F = .09$$

$$R_5 = .44$$

$$M_{EF} = (.50 + \frac{.09}{2} - .44) = .10$$

$$M_{FE} = (.09 + \frac{.50}{2} - .44) = -.10$$

Panel 6

$$-.26G + 1.76F = -.06$$

$$1.78G - .21F = 0$$

$$F = -.35 \quad G = 0$$

$$M_{FG} = (-.35 - 0 + .26) = -.09$$

$$M_{GF} = (0 - .35 + .26) = .09$$

Panel 7

$$-.26H + 1.76G = -.03$$

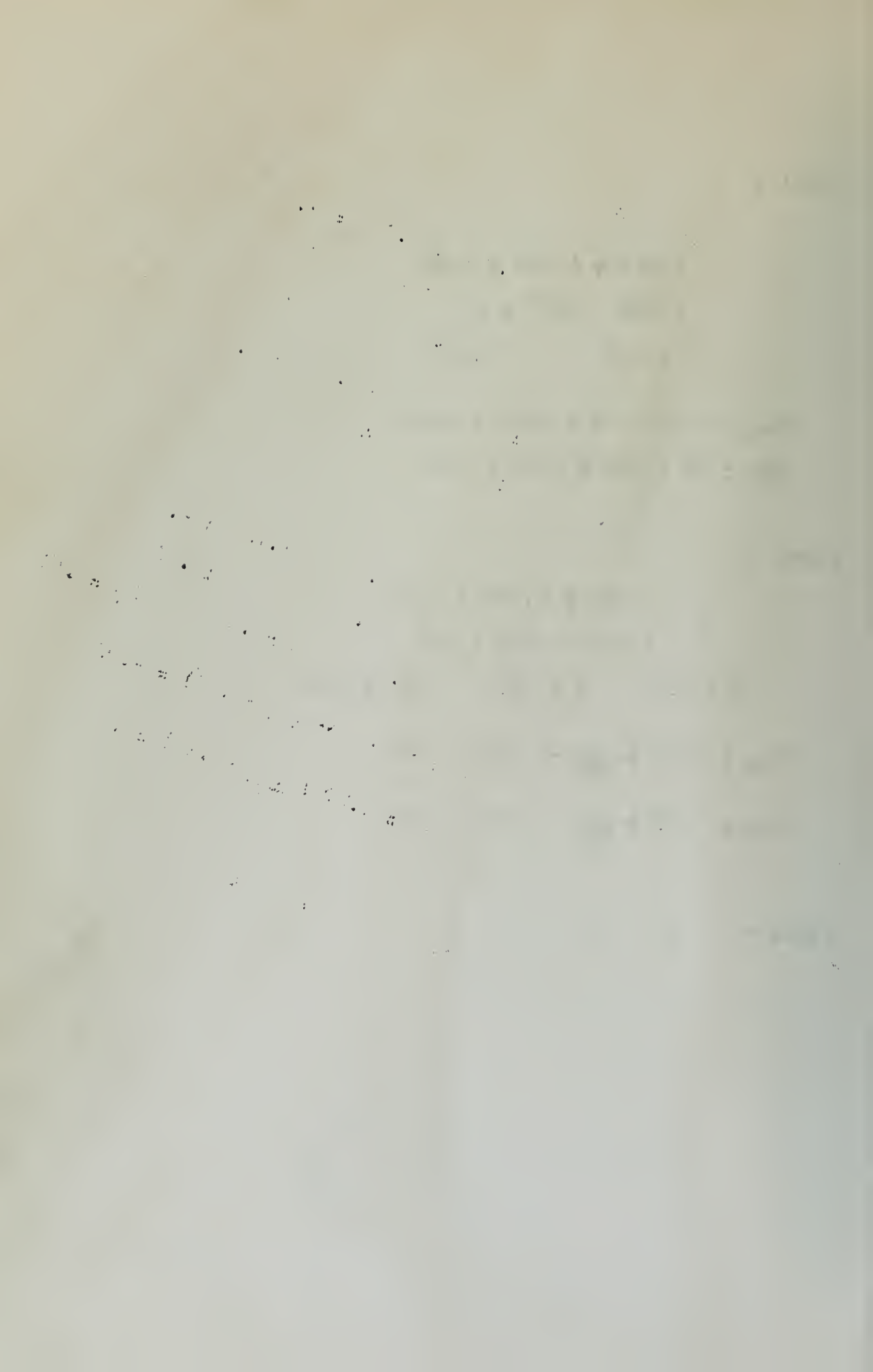
$$1.78H - .21G = .36$$

$$G = .01 \quad H = .20 \quad R_7 = .16$$

$$M_{GH} = (.01 + \frac{.20}{2} - .16) = -.05$$

$$M_{HG} = (.20 + \frac{.01}{2} - .16) = .04$$

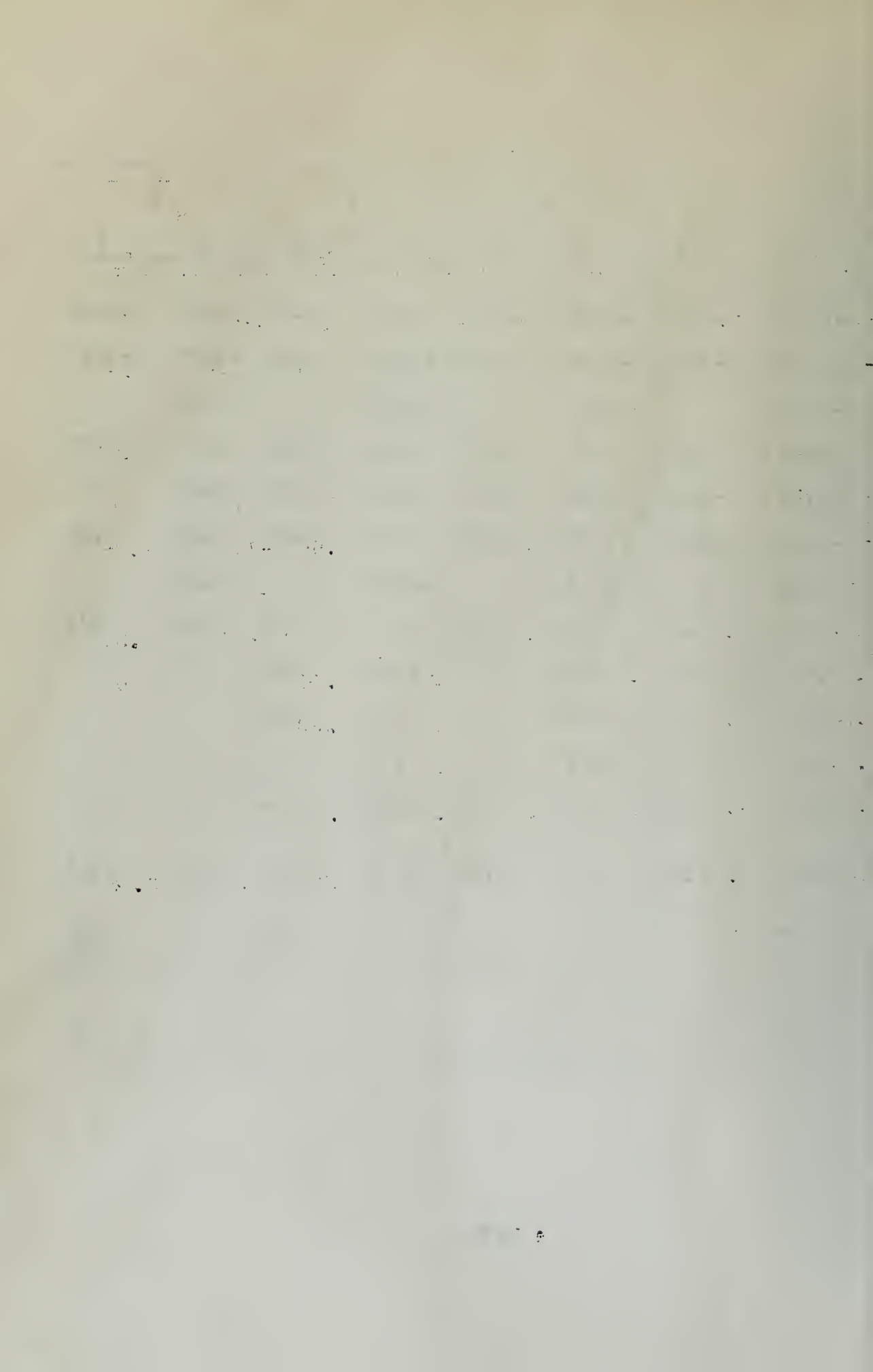
Panel 8 = 0



LOAD AT D

| Panel
Point | 1 | | 2 | | 3 | | 4 | |
|----------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | A | B | B | C | C | D | D | E |
| -Q | 4.12 | 4.49 | 4.14 | 4.36 | 3.91 | 4.12 | 2.82 | -2.82 |
| | 2.54 | 2.92 | 2.67 | 2.87 | 2.52 | 2.71 | -1.88 | -1.88 |
| R | 8.59 | | 8.51 | | 8.04 | | -5.64 | |
| M' | -4.59 | -4.40 | -4.41 | -4.31 | -4.17 | -4.07 | 2.82 | 2.82 |
| -Q | 0 | 4.41 | 4.40 | 4.17 | 4.31 | -2.82 | 4.07 | -2.82 |
| | .24 | 2.54 | 2.80 | 2.78 | 2.27 | -1.27 | 2.14 | -1.30 |
| R | 2.06 | | 4.18 | | .78 | | .63 | |
| M'' | -.57 | .59 | 0 | 0 | .86 | -.92 | .86 | -.86 |
| -Q | 0 | 0 | -.59 | -.86 | 0 | -.86 | .92 | .04 |
| | | | -.40 | -.55 | -.06 | -.50 | .54 | .10 |
| R | | | -.71 | | -.42 | | .48 | |
| M'' | 0 | 0 | .04 | -.04 | .11 | -.11 | .11 | -.11 |
| M | -5.16 | -3.81 | -4.37 | -4.35 | -3.20 | -5.10 | 3.79 | 1.85 |

| Panel | 5 | | 6 | | 7 | | 8 | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Point | E | F | F | G | G | H | H | I |
| -Q | -2.82 | -2.82 | -2.46 | -2.34 | -2.61 | -2.49 | -2.70 | -2.43 |
| Q | -1.89 | -1.82 | -1.62 | -1.50 | -1.71 | -1.59 | -1.77 | -1.50 |
| R | -5.34 | | -4.80 | | -5.10 | | -5.13 | |
| M' | 2.82 | 2.82 | 2.43 | 2.49 | 2.61 | 2.67 | 2.61 | 2.79 |
| -Q | -2.82 | -2.43 | -2.32 | -2.61 | -2.49 | -2.61 | -2.67 | 0 |
| Q | -1.85 | -1.65 | -1.69 | -1.85 | -1.66 | -1.66 | -1.54 | -.14 |
| R | -2.63 | | -2.56 | | -2.49 | | -1.25 | |
| M'' | -.04 | .06 | -.03 | .05 | 0 | 0 | -.36 | .34 |
| -Q | .86 | .05 | -.06 | 0 | -.03 | .36 | 0 | 0 |
| Q | .50 | .09 | -.35 | 0 | .01 | .20 | | |
| R | .44 | | -.26 | | .15 | | | |
| M'' | .10 | -.10 | -.09 | .09 | -.05 | .04 | 0 | 0 |
| Σ M | 2.88 | 2.78 | 2.33 | 2.61 | 2.53 | 2.71 | 2.25 | 3.13 |



Influence Line Corrections-Load at E
First Set

Panels 1,8

$$1.82A - .17B = 0$$

$$-.26A + 1.76B = 3.53$$

$$A = -.19 \quad B = 2.03 \quad R_1 = 1.65$$

$$M_{AB} = (.19 + \frac{2.03}{2} - 1.65) = -.45$$

$$M_{BA} = (2.03 + \frac{.19}{2} - 1.65) = .47$$

Panel 2,7

$$1.78B - .21C = 3.48$$

$$-.26B + 1.76C = 3.24$$

$$B = 2.21 \quad C = 2.17 \quad R_2 = 3.28$$

$$M_{BC} = (2.21 + \frac{2.17}{2} - 3.28) = .01$$

$$M_{CB} = (2.17 + \frac{2.21}{2} - 3.28) = -.01$$

Panels 3,6

$$1.78C - .21D = 3.45$$

$$-.26C + 1.76D = 3.76$$

$$C = 2.23 \quad D = 2.46 \quad R_3 = 3.52$$

$$M_{CD} = (2.23 + \frac{2.46}{2} - 3.52) = -.06$$

$$M_{DC} = (2.46 + \frac{2.23}{2} - 3.52) = .05$$

Panels 4,5

$$1.75D - .25E = 3.24$$

$$-.25D + 1.75E = -3.76$$

$$D = 1.58 \quad E = -1.92 \quad R_4 = -.25$$

$$M_{DE} = (1.58 + \frac{1.92}{2} + .25) = .87$$

$$M_{ED} = (-1.92 + \frac{1.58}{2} + .25) = -.88$$

Influence Line Corrections-Load at E Second Set

panels 1,8

0

panels 2,7

$$1.78B - .21C = -.47$$

$$-.26B + 1.76C = .06$$

$$B = -.26 \quad C = -.01 \quad R_2 = -.20$$

$$M_{BC} = (.01 - \frac{.26}{2} + .20) = .06$$

$$M_{CB} = (-.01 - .26 + 2.0) = .06$$

panels 3,6

$$1.75C - .21D = .01$$

$$-.26C + 1.76D = -.87$$

$$C = -.05 \quad D = -.50 \quad R_3 = -.41$$

$$M_{CD} = (.05 - \frac{.50}{2} + .41) = .11$$

$$M_{DC} = (-.50 - \frac{.05}{2} + .41) = -.11$$

panels 4,5

$$1.75D - .25E = -.05$$

$$-.25D + 1.75E = -.88$$

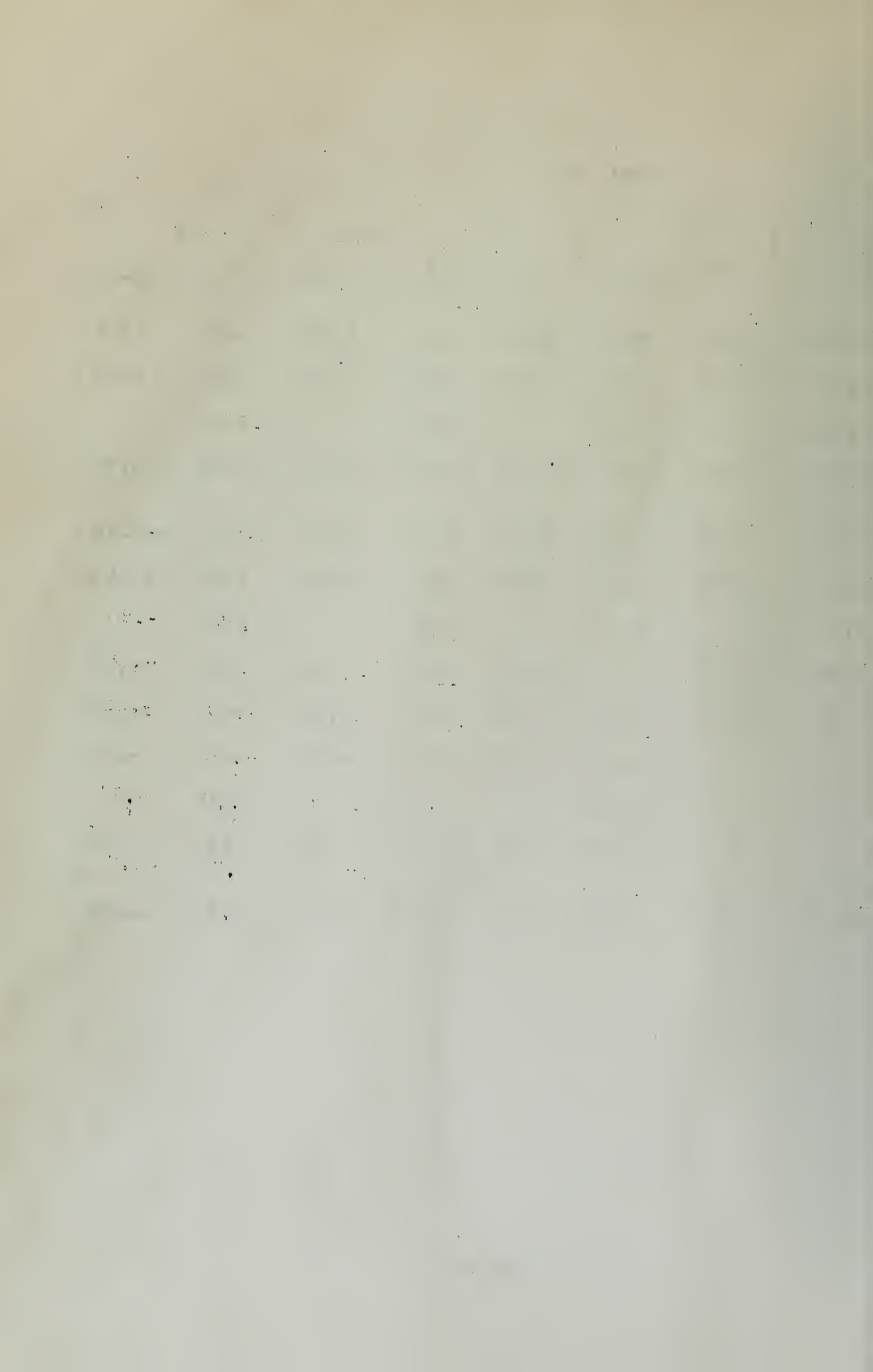
$$D = -.10 \quad E = -.52 \quad R_4 = -.46$$

$$M_{DE} = (-.10 - \frac{.52}{2} + .46) = .10$$

$$M_{ED} = (-.52 - \frac{.10}{2} + .46) = -.11$$

Load at E

| Inel
Point | 1 | | 2 | | 3 | | 4 | |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | A | B | B | C | C | D | D | E |
| | 3.24 | 3.60 | 3.32 | 3.48 | 3.12 | 3.28 | 3.76 | 3.76 |
| | 2.00 | -2.36 | 2.12 | 2.28 | 2.00 | 2.16 | 2.52 | 2.52 |
| | 6.84 | | 6.81 | | 6.40 | | 7.52 | |
| | -3.72 | -3.48 | -3.53 | -3.45 | -3.24 | -3.24 | -3.76 | -3.76 |
| | 0 | 3.53 | 3.48 | 3.24 | 3.45 | 3.76 | 3.24 | -3.76 |
| | .19 | 2.03 | 2.31 | 2.17 | 2.23 | 2.46 | 1.58 | -1.92 |
| | 1.65 | | 3.28 | | 3.52 | | -.25 | |
| | -.45 | .47 | .01 | -.01 | -.06 | .05 | .87 | -.88 |
| | 0 | -.01 | -.47 | .06 | .01 | -.87 | -.05 | -.88 |
| | | | -.26 | -.01 | -.05 | -.50 | -.10 | -.52 |
| | | | -.20 | | -.41 | | -.46 | |
| | | | -.06 | .06 | .11 | -.11 | .10 | -.11 |
| | -4.17 | -3.01 | -3.58 | -3.40 | -3.19 | -3.30 | -2.79 | -4.75 |



Moment Computations

| | | |
|---------------|---------|--------------|
| Member AA' | DL | = 3422 fk |
| | LL E-60 | = 3005 |
| | Impact | = <u>643</u> |
| | Total | 7070 |
| LL H15-S12-44 | | = 401 |
| Conc. | | = 91 |
| Impact | | = <u>68</u> |
| Total | | 560 |
| Sidewalk | | = 259 |
| Design Moment | | = 7,869 fk |
| Member BB' | DL | = 4680 fk |
| | LL E-60 | = 3990 |
| | Impact | = <u>835</u> |
| | Total | 9505 |
| LL H15-S12-44 | | = 548 |
| Conc. | | = 128 |
| Impact | | = <u>93</u> |
| Total | | 769 |
| Sidewalk | | = 326 |
| Design Moment | | = 10,600 fk |
| Member CC' | DL | = 3230 fk |
| | LL E-60 | = 2945 |
| | Impact | = <u>728</u> |
| | Total | 6903 |
| LL H15-S12-44 | | = 384 |
| Conc. | | = 115 |
| Impact | | = <u>82</u> |
| Total | | 581 |
| Sidewalk | | = 247 |
| Design Moment | | = 7,781 fk |

| nel
Int | 5 | | 6 | | 7 | | 8 | |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | E | F | F | G | G | H | H | I |
| -Q | -3.76 | -3.76 | -3.28 | -3.12 | -3.48 | -3.32 | -3.60 | -3.24 |
| C | -2.52 | -2.52 | -2.16 | -2.00 | -2.28 | -2.12 | -2.36 | -2.00 |
| R | -7.52 | | -6.40 | | -6.81 | | -6.84 | |
| M' | 3.76 | 3.76 | 3.24 | 3.24 | 3.45 | 3.53 | 3.48 | 3.72 |
| -Q | 3.76 | -3.23 | -3.76 | -3.45 | -3.24 | -3.48 | -3.53 | 0 |
| | 1.92 | -1.58 | -2.46 | -2.23 | -2.17 | -2.21 | -2.03 | -.19 |
| R | .25 | | -3.52 | | -3.28 | | -1.65 | |
| M'' | .88 | -.87 | -.05 | .06 | .01 | -.01 | -.47 | .45 |
| Q | .88 | .05 | .87 | -.01 | -.06 | .47 | .01 | 0 |
| C | .52 | .10 | .50 | .05 | .01 | .26 | | |
| R | .46 | | .41 | | .20 | | | |
| M''' | .11 | -.10 | .11 | -.11 | -.06 | .06 | 0 | 0 |
| M | 4.75 | 2.79 | 3.30 | 3.19 | 3.40 | 3.58 | 3.01 | 4.17 |
| | | | | | | | | |
| | | | | | | | | |

Member DL'

| | | | |
|---------------|---|------------|----|
| DL | = | 2132 | fk |
| LL-E60 | = | 1950 | |
| Impact | = | <u>536</u> | |
| Total | = | 4618 | |
| LL-H15-S12-44 | = | 240 | |
| Conc. | = | 88 | |
| Impact | = | <u>53</u> | |
| Total | = | 381 | |
| Sidewalk | = | 171 | |
| Design Moment | = | 5,170 | fk |

Member EE'

| | | | |
|---------------|---|------------|----|
| DL | = | 1267 | fk |
| LL-E60 | = | 1213 | |
| Impact | = | <u>425</u> | |
| Total | = | 2905 | |
| Sidewalk | = | 114 | |
| Design Moment | = | 3,282 | fk |

Member AB

| | | | |
|---------------|---|------------|----|
| DL | = | 3422 | fk |
| LL-E60 | = | 5005 | |
| Impact | = | <u>643</u> | |
| Total | = | 7070 | |
| LL-H15-S12-44 | = | 401 | |
| Conc. | = | 91 | |
| Impact | = | <u>68</u> | |
| Total | = | 560 | |
| Sidewalk | = | 239 | |
| Design Moment | = | 7,689 | fk |

Member BC

| | | | |
|---------------|---|------------|----|
| DL | = | 2326 | fk |
| LL-E60 | = | 2092 | |
| Impact | = | <u>481</u> | |
| Total | = | 4849 | |
| LL-H15-S12-44 | = | 272 | |
| Conc. | = | 75 | |
| Impact | = | <u>52</u> | |
| Total | = | 397 | |
| Sidewalk | = | 169 | |
| Design Moment | = | 5,465 | fk |

Member CD

| | | | |
|---------------|---|------------|----|
| DL | = | 1666 | fk |
| LL-E60 | = | 1551 | |
| Impact | = | <u>398</u> | |
| Total | = | 3615 | |
| LL-H15-H12-44 | = | 195 | |
| Conc. | = | 64 | |
| Impact | = | <u>44</u> | |
| Total | = | 303 | |
| Sidewalk | = | 125 | |
| Design Moment | = | 4,043 | fk |

Member DE

| | | | |
|---------------|---|------------|----|
| DL | = | 1192 | fk |
| LL-E60 | = | 1150 | |
| Impact | = | <u>345</u> | |
| Total | = | 2687 | |
| LL-H15-S12-44 | = | 140 | |
| Conc. | = | 56 | |
| Impact | = | <u>57</u> | |
| Total | = | 233 | |
| Sidewalk | = | 100 | |
| Design Moment | = | 3,020 | fk |

Influence Line Computations - Fourth Set

Load at B

Panel 1

$$-Q_A = \frac{(.0942 - 4)(.0866 \times 26.25 - .875 \times 30)}{2(2 - .0866)4} = 6.14$$

$$-Q_B = \frac{(.875 \times 30 - .0866 \times 26.25)}{2(2 - .0866)} = 6.28$$

$$Q_{R1} = \frac{(.875 \times 30 - .0866 \times 26.25)}{2(2 - .0866)4} = 1.57$$

Panel 2

$$-Q_B = \frac{(.0463 \times 1 - 4)(.0443 \times 22.5 + .125 \times 30)}{2(2 - .0443)4} = -1.20$$

$$-Q_C = \frac{(-.125 \times 30 - 22.5 \times .0443)}{2(2 - .0443)} = -1.21$$

$$Q_{R2} = \frac{(-.125 \times 30 - 22.5 \times .0443)}{2(2 - .0443)4} = -.30$$

Panel 3

$$-Q_C = \frac{(.0507 \times 2 - 3)(.0482 \times 18.75 + .125 \times 30)}{2(2 - .0482)3} = -1.16$$

$$-Q_D = \frac{(-.125 \times 30 - .0482 \times 18.75)}{2(2 - .0482)} = -1.19$$

$$Q_{R3} = \frac{(-.125 \times 30 - .0482 \times 18.75)}{2(2 - .0482)3} = -.40$$

Panel 4

$$-Q_D = \frac{-2(.125 \times 30)}{4 \times 2} = -.94$$

$$-Q_E = \frac{(-.125 \times 30)}{4} = -.94$$

$$Q_{R4} = \frac{(-.125 \times 30)}{4 \times 2} = -.47$$

$$x_{n+1} = \frac{(x_n^2 + 1) - (x_n^2 - 1)}{2} = \frac{2}{2} = 1$$

$$x_{n+1} = \frac{x_n^2 + 1}{x_n^2 - 1}$$

$$x_{n+1} = \frac{x_n^2 + 1}{x_n^2 - 1}$$

$$x_{n+1} = \frac{x_n^2 + 1}{x_n^2 - 1}$$

$$x_{n+1} = \frac{x_n^2 + 1}{x_n^2 - 1}$$

$$x_{n+1} = \frac{x_n^2 + 1}{x_n^2 - 1}$$

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$$x_{n+1} = \frac{x_n^2 + 1}{x_n^2 - 1}$$

$$x_{n+1} = \frac{x_n^2 + 1}{x_n^2 - 1}$$

$$x_{n+1} = \frac{x_n^2 + 1}{x_n^2 - 1}$$

Panel 5

$$-Q_E = \frac{-0.125 \times 30}{4} = -0.94$$

$$-Q_T = \frac{-0.125 \times 30}{4} = -0.94$$

$$Q_{R5} = \frac{-0.125 \times 30}{4 \times 2} = -0.47$$

Panel 6

$$-Q_T = \frac{(-0.125 \times 30 + 0.0482 \times 30)}{2(2 - 0.0482)} = -0.82$$

$$-Q_G = \frac{(0.0507 \times 2 - 3)(-0.0482 \times 11.25 + 0.125 \times 30)}{2(2 - 0.0482)3} = -0.79$$

$$Q_{R6} = \frac{(-0.125 \times 30 + 0.0482 \times 11.25)}{2(2 - 0.0482)3} = -0.27$$

Panel 7

$$-Q_G = \frac{(-0.125 \times 30 + 0.0443 \times 7.5)}{2(2 - 0.0443)} = -0.87$$

$$-Q_H = \frac{(0.0463 \times 1 - 4)(-0.0443 \times 7.5 + 0.125 \times 30)}{2(2 - 0.0443)4} = -0.86$$

$$Q_{R7} = \frac{(-0.125 \times 30 + 0.0443 \times 7.5)}{2(2 - 0.0443)4} = -0.22$$

Panel 8

$$-Q_H = \frac{(-0.125 \times 30 + 0.0866 \times 3.75)}{2(2 - 0.0866)} = -0.90$$

$$-Q_I = \frac{(0.0942 \times 1 - 4)(-0.0866 \times 3.75 + 0.125 \times 30)}{2(2 - 0.0866)4} = -0.88$$

$$Q_{R8} = \frac{(-0.125 \times 30 + 0.0866 \times 3.75)}{2(2 - 0.0866)4} = -0.22$$

Load at C

Panel 1

$$-Q_A = \frac{(.0942 \times 1 - 4)(.0866 \times 22.5 - .75 \times 30)}{2(2 - .0866)4} = 5.27$$

$$-Q_B = \frac{(.75 \times 30 - .0866 \times 22.5)}{2(2 - .0866)} = 5.38$$

$$Q_{R1} = \frac{(.75 \times 30 - .0866 \times 22.5)}{2(2 - .0866)4} = 1.35$$

Panel 2

$$-Q_B = \frac{(.0463 \times 1 - 4)(.0443 \times 45 - .75 \times 30)}{2(2 - .0443)4} = 5.17$$

$$-Q_C = \frac{(.75 \times 30 - .0443 \times 45)}{2(2 - .0443)} = 5.23$$

$$Q_{R2} = \frac{(.75 \times 30 - .0443 \times 45)}{2(2 - .0443)4} = 1.31$$

Panel 3

$$-Q_C = \frac{(.0507 \times 2 - 3)(.0482 \times 37.5 + .25 \times 30)}{2(2 - .0482)3} = -2.31$$

$$-Q_D = \frac{(-.25 \times 30 - .0482 \times 37.5)}{2(2 - .0482)} = -2.38$$

$$Q_{R3} = \frac{(-.25 \times 30 - .0482 \times 37.5)}{2(2 - .0482)3} = -.79$$

Panel 4

$$-Q_D = \frac{-2(.25 \times 30)}{4 \times 2} = -1.87$$

$$-Q_E = \frac{(-.25 \times 30)}{4} = -1.87$$

$$Q_{R4} = \frac{-.25 \times 30}{4 \times 2} = -.94$$

1. The first part of the paper is devoted to a general discussion of the problem.

2. In the second part, we shall consider the case of a single particle.

3. The third part is devoted to the case of a system of particles.

4. In the fourth part, we shall discuss the results of our calculations.

5. The fifth part is devoted to a discussion of the experimental results.

6. In the sixth part, we shall discuss the conclusions of our work.

7. Finally, we shall give some references.

8. The first part of the paper is devoted to a general discussion of the problem.

9. In the second part, we shall consider the case of a single particle.

10. The third part is devoted to the case of a system of particles.

11. In the fourth part, we shall discuss the results of our calculations.

12. The fifth part is devoted to a discussion of the experimental results.

13. In the sixth part, we shall discuss the conclusions of our work.

Panel 5

$$-Q_T = -1.88$$

$$-Q_F = -1.88$$

$$Q_{R5} = -0.94$$

Panel 6

$$-Q_T = -1.64$$

$$-Q_G = -1.58$$

$$Q_{R6} = -0.54$$

Panel 7

$$-Q_G = -1.74$$

$$-Q_H = -1.72$$

$$Q_{R7} = -0.44$$

Panel 8

$$-Q_H = -1.80$$

$$-Q_I = -1.76$$

$$Q_{R8} = -0.45$$

Load at D

Panel 1

$$-Q_A = \frac{(.0942 \times 1 - 4)(.0866 \times 18.75 - .625 \times 30)}{2(2 - .0866)4} = 4.38$$

$$-Q_B = \frac{(.625 \times 30 - .0866 \times 18.75)}{2(2 - .0866)} = 4.49$$

$$Q_{R1} = \frac{(.625 \times 30 - .0866 \times 18.75)}{2(2 - .0866)4} = 1.12$$

Panel 2

$$-Q_B = \frac{(.0463 \times 1 - 4)(.0443 \times 37.5 - .625 \times 30)}{2(2 - .0443)4} = 4.31$$

$$-Q_C = \frac{(.625 \times 30 - .0443 \times 37.5)}{2(2 - .0443)} = 4.36$$

$$Q_{R2} = \frac{(.625 \times 30 - .0443 \times 37.5)}{2(2 - .0443)4} = 1.09$$

Panel 3

$$-Q_C = \frac{(.0507 \times 2 - 3)(.0482 \times 56.25 - .625 \times 30)}{2(2 - .0482)3} = 3.98$$

$$-Q_D = \frac{(.625 \times 30 - .0482 \times 56.25)}{2(2 - .0482)} = 4.12$$

$$Q_{R3} = \frac{(.625 \times 30 - .0482 \times 56.25)}{2(2 - .0482)3} = 1.37$$

Panel 4

$$-Q_D = \frac{-2(.375 \times 30)}{4 \times 2} = -2.82$$

$$-Q_E = \frac{(-.375 \times 30)}{4} = -2.82$$

$$Q_{R4} = \frac{(-.375 \times 30)}{4 \times 2} = -1.41$$

Panel 5

$$-Q_E = -2.82$$

$$-Q_F = -2.82$$

$$Q_{R5} = -1.41$$

Panel 6

$$-Q_I = -2.46$$

$$-Q_G = -2.37$$

$$Q_{R6} = -0.81$$

Panel 7

$$-Q_G = -2.61$$

$$-Q_H = -2.58$$

$$Q_{R7} = -0.66$$

Panel 8

$$-Q_H = -2.70$$

$$-Q_I = -2.64$$

$$Q_{R8} = -0.67$$

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Load at E

Panel 1

$$-Q_A = \frac{(.0942 \times 1 - 4)(.0866 \times 15 - .5 \times 30)}{2(2 - .0866)4} = 3.51$$

$$-Q_B = \frac{(.5 \times 30 - .0866 \times 15)}{2(2 - .0866)} = 3.59$$

$$Q_{R_1} = \frac{(.5 \times 30 - .0866 \times 15)}{2(2 - .0866)4} = .90$$

Panel 2

$$-Q_B = \frac{(.0463 \times 1 - 4)(.0443 \times 30 - .5 \times 30)}{2(2 - .0443)4} = 3.44$$

$$-Q_C = \frac{(.5 \times 30 - .0443 \times 30)}{2(2 - .0443)} = 3.49$$

$$Q_{R_2} = \frac{(.5 \times 30 - .0443 \times 30)}{2(2 - .0443)4} = .87$$

Panel 3

$$-Q_C = \frac{(.0507 \times 2 - 3)(.0482 \times 45 - .5 \times 30)}{2(2 - .0482)3} = 3.18$$

$$-Q_D = \frac{(.5 \times 30 - .0482 \times 45)}{2(2 - .0482)} = 3.30$$

$$Q_{R_3} = \frac{(.5 \times 30 - .0482 \times 45)}{2(2 - .0482)3} = 1.10$$

Panel 4

$$-Q_D = \frac{-2(-.5 \times 30)}{4 \times 2} = 3.75$$

$$-Q_E = \frac{(.5 \times 30)}{4} = 3.75$$

$$Q_{R_4} = \frac{(.5 \times 30)}{4 \times 2} = 1.88$$

Panel 5

$$-Q_E = -3.76$$

$$-Q_F = -3.76$$

$$Q_{R_5} = -1.88$$

Panel 6

$$-Q_F = -3.28$$

$$-Q_G = -3.16$$

$$Q_{R_6} = -1.08$$

Panel 7

$$-Q_G = -3.48$$

$$-Q_H = -3.44$$

$$Q_{R_7} = -0.88$$

Panel 8

$$-Q_H = -3.60$$

$$-Q_I = -3.52$$

$$Q_{R_8} = -0.90$$

Determination of formulae for Panel Constant Computations

el 1

$$5 + 4 + \left[\frac{(3 - .0866)(.0942 - 4)}{2(2 - .0866)} \right] A + \left[2 + \frac{(3 - .1732)(.0942 - 4)}{2(2 - .0866)} \right] B = -Q_A$$

$$2.52A - .90B = -Q_A$$

$$1.5 - \left[\frac{(3 - .1732)4}{2(2 - .0866)} \right] B + \left[2 - \frac{(3 - .0866)4}{2(2 - .0866)} \right] A = -Q_B$$

$$2.54B - 1.04A = -Q_B$$

el 2

$$5 + 4 + \left[\frac{(3 - .0443)(.0463 - 4)}{2(2 - .0443)} \right] A + \left[2 + \frac{(3 - .0886)(.0463 - 4)}{2(2 - .0443)} \right] B = -Q_A$$

$$2.52A - .93B = -Q_A$$

$$3 - \left[\frac{(3 - .0886)4}{2(2 - .0443)} \right] B + \left[2 - \frac{(3 - .0443)4}{2(2 - .0443)} \right] A = -Q_B$$

$$4.03B - 1.02A = -Q_B$$

nel 3

$$5x2 + 3 + \left[\frac{(3 - .0482)(.0507x2-3)}{2(2 - .0482)} \right] A + \left[1.5 + \frac{(3 - .0946)(.0507x2-3)}{2(2 - .0482)} \right] B = -Q_A$$

$$3.31A - .65B = -Q_A$$

$$4.5 - \left[\frac{(3 - .0946)3}{2(2 - .0482)} \right] B + \left[1.5 - \frac{(3 - .0482)3}{2(2 - .0482)} \right] A = -Q_B$$

$$5.26B - .77A = -Q_B$$

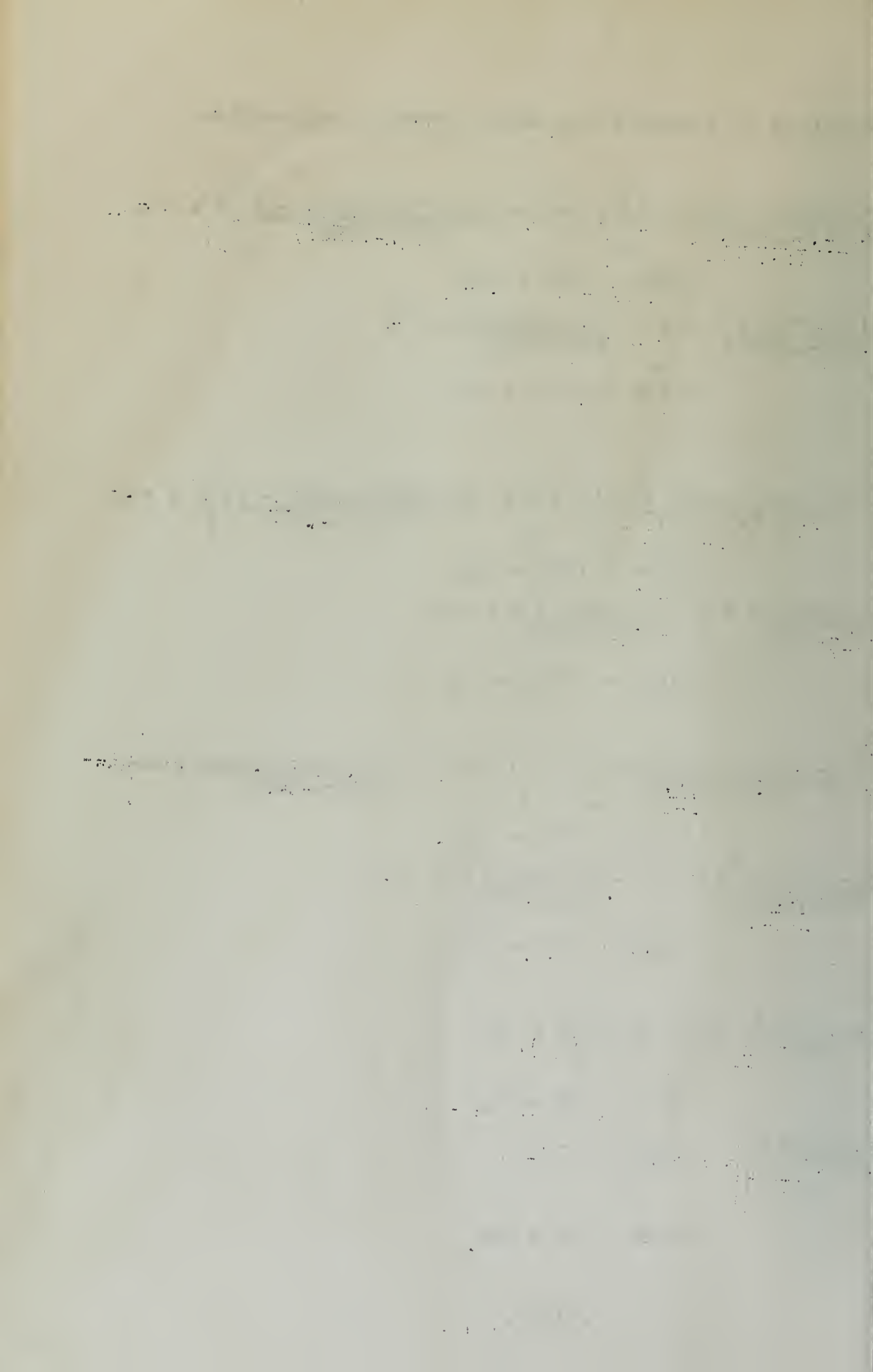
nel 4

$$4.5 + 2 + \left[\frac{3(-2)}{4} \right] A + \left[1 + \frac{3(-2)}{4} \right] B = -Q_A$$

$$5.0A - .5B = -Q_A$$

$$2 + 6 - \left[\frac{3(2)}{4} \right] B + \left[1 - \frac{3(2)}{4} \right] A = -Q_B$$

$$6.5B - .5A = -Q_B$$



Panel 5

$$\left[1.5 \times 4 + \frac{2}{4} \right] E - \frac{2}{4} F = -Q_E$$

$$6.5E - 0.5F = -Q_E$$

$$\left[1.5 \times 3 + \frac{2}{4} \right] F - \frac{2}{4} E = -Q_F$$

$$5.0F - 0.5E = -Q_F$$

Panel 6

$$\left[3 + 1.5 \times 3 - \frac{(3-2 \times .0482)3}{2(2-.0482)} \right] F + \left[\frac{3}{2} - \frac{(3-.0482)(3)}{2(2-.0482)} \right] G = -Q_F$$

$$5.26F - 0.77G = -Q_F$$

$$\left[2 + 3 + \frac{(3-.0482)(.0507 \times 2 - 3)}{2(2-.0482)} \right] G + \left[\frac{3}{2} + \frac{(3-2 \times .0482)(.0507 \times 2 - 3)}{2(2-.0482)} \right] F = -Q_G$$

$$3.81G - 0.65F = -Q_G$$

Panel 7

$$\left[4 + 1.5 \times 2 - \frac{(3-2 \times .0443)4}{2(2-.0443)} \right] G + \left[\frac{4}{2} - \frac{(3-.0443)4}{2(2-.0443)} \right] H = -Q_G$$

$$4.03G - 1.02H = -Q_G$$

$$\left[1 + 4 + \frac{(3-.0443)(.0463 \times 1 - 4)}{2(2-.0443)} \right] H + \left[\frac{4}{2} + \frac{(3-2 \times .0443)(.0463 \times 1 - 4)}{2(2-.0443)} \right] G = -Q_H$$

$$2.52H - 0.93G = -Q_H$$

Panel 8

$$\left[4 + 1.5 \times 1 - \frac{(3-2 \times .0866)4}{2(2-.0866)} \right] F + \left[\frac{4}{2} - \frac{(3-.0866)4}{2(2-.0866)} \right] I = -Q_H$$

$$2.54H - 1.040 = -Q_H$$

$$\left[.5 \times 1 + 4 + \frac{(3-.0866)(.0942 \times 1 - 4)}{2(2-.0866)} \right] I + \left[\frac{4}{2} - \frac{(3-2 \times .0866)(.0942 \times 1 - 4)}{2(2-.0866)} \right] H = -Q_I$$

$$2.52I - 0.90 = -Q_I$$

$$-\frac{1}{2} \left(\frac{1}{1-x} \right) = -\frac{1}{2} \sum_{n=0}^{\infty} x^n$$

$$12 \cdot 2 = 24$$

$$(12 \cdot 2) \cdot (12 \cdot 2)$$

Joint Constant Computation - Load at B

Panel 1

$$2.52A - .90B = 6.14$$

$$-1.04A + 2.54B = 6.28$$

$$A = 3.89 \quad B = 4.07$$

$$R_1 = \frac{2.91 \times 3.89 + 2.83 \times 4.07}{3.82} + 1.57 = 7.45$$

$$M_{AB} = 4(3.89 + \frac{4.07}{2} - 7.45) = -6.12$$

$$M_{BA} = 4(4.07 + \frac{3.89}{2} - 7.45) = -5.80$$

Panel 2

$$2.52B - .93C = -1.20$$

$$-1.02B + 4.03C = -1.21$$

$$B = -.65 \quad C = -.46$$

$$R_2 = \frac{-2.96 \times .65 - 2.91 \times .46}{3.92} - .30 = -1.13$$

$$M_{BC} = 4(-.65 - \frac{.46}{2} + 1.13) = 1.00$$

$$M_{CB} = 4(-.46 - \frac{.65}{2} + 1.13) = 1.40$$

Panel 3

$$3.81C - .65D = -1.16$$

$$-.77C + 5.25D = -1.19$$

$$C = -.35 \quad D = -.28$$

$$R_3 = \frac{-2.95 \times .35 - 2.90 \times .28}{3.90} - .40 = -.87$$

$$M_{CD} = 3(-.35 - \frac{.28}{2} + .87) = 1.14$$

$$M_{DC} = 3(-.28 - \frac{.35}{2} + .87) = 1.26$$

Panel 4

$$5.0D - .5E = -.94$$

$$-.5D + 6.5E = -.94$$

$$D = -.20 \quad E = -.16$$

$$R_4 = 3/4(-.20 - .16) + .47 = -.74$$

$$M_{DE} = 2(-.20 - \frac{.16}{2} + .74) = .92$$

$$M_{ED} = 2(-.16 - \frac{.20}{2} + .74) = .96$$

anel 5

$$6.5E - 0.5F = -0.94$$

$$-0.5E + 5.0F = -0.94$$

$$E = -0.16$$

$$F = -0.20$$

$$R_5 = \frac{3}{4}(-.20 - .16) - 0.47 = -.74$$

$$M_{EF} = 2(-.16 - \frac{.20}{2} + .74) = .96$$

$$M_{FE} = 2(-.20 - \frac{.16}{2} + .74) = .92$$

anel 6

$$5.26F - 0.77G = -0.82$$

$$-0.65F + 3.81G = -0.79$$

$$F = -0.19 \quad G = -0.24$$

$$R_6 = \frac{-2.90 \times .19 - 2.95 \times .24}{3.90} - 0.27 = -0.59$$

$$M_{FG} = 3(-.19 - \frac{.24}{2} + .59) = .84$$

$$M_{GF} = 3(-.24 - .19 + .59) = .75$$

anel 7

$$4.03G - 1.02H = -0.87$$

$$-0.93G + 2.52H = -0.86$$

$$G = -0.33 \quad H = -0.46$$

$$R_7 = \frac{-2.91 \times .33 - 2.96 \times .46}{3.91} - 0.22 = -0.82$$

$$M_{GH} = 4(-.33 - \frac{.44}{2} + .82) = 1.04$$

$$M_{HG} = 4(-.46 - \frac{.33}{2} + .82) = .80$$

anel 8

$$2.54H - 1.04I = -0.90$$

$$-0.90H + 2.52I = -0.88$$

$$H = -0.58 \quad I = -0.56$$

$$R_8 = \frac{-2.83 \times 0.58 - 2.91 \times 0.56}{3.83} - .22 = -1.08$$

$$M_{HI} = 4(-.58 - \frac{.56}{2} + 1.08) = .88$$

$$M_{IH} = 4(-.56 - \frac{.58}{2} + 1.08) = .92$$

Load at C

Panel 1

$$\begin{aligned} 2.52A - .90B &= 5.27 \\ -1.04A + 2.54B &= 5.38 \end{aligned}$$

$$A = 3.33 \quad B = 3.48$$

$$R_1 = \frac{2.91 \times 3.33 + 2.83 \times 3.48}{3.82} + 1.35 = 6.47$$

$$M_{AB} = 4\left(3.33 + \frac{3.48}{2} - 6.47\right) = -5.88$$

$$M_{BA} = 4\left(3.48 + \frac{3.33}{2} - 6.47\right) = -5.32$$

Panel 2

$$\begin{aligned} 2.52B - .93C &= 5.17 \\ -1.02B + 4.03C &= 5.23 \end{aligned}$$

$$B = 2.79 \quad C = 2.0$$

$$R_2 = \frac{2.96 \times 2.79 + 2.91 \times 2.0}{3.92} + 1.31 = 4.90$$

$$M_{BC} = 4\left(2.79 + \frac{2.0}{2} - 4.90\right) = -4.44$$

$$M_{CB} = 4\left(2.0 + \frac{2.79}{2} - 4.90\right) = -6.04$$

Panel 3

$$\begin{aligned} 3.81C - .65D &= -2.31 \\ -.77C + 5.26D &= -2.33 \end{aligned}$$

$$C = -.70 \quad D = -.56$$

$$R_3 = \frac{-2.95 \times .70 - 2.90 \times .56}{3.90} - .79 = -1.74$$

$$M_{CD} = 3\left(-.70 - \frac{.56}{2} + 1.74\right) = 2.28$$

$$M_{DC} = 3\left(-.56 - \frac{.70}{2} + 1.74\right) = 2.49$$

Panel 4

$$5.0D - .5E = -1.87$$

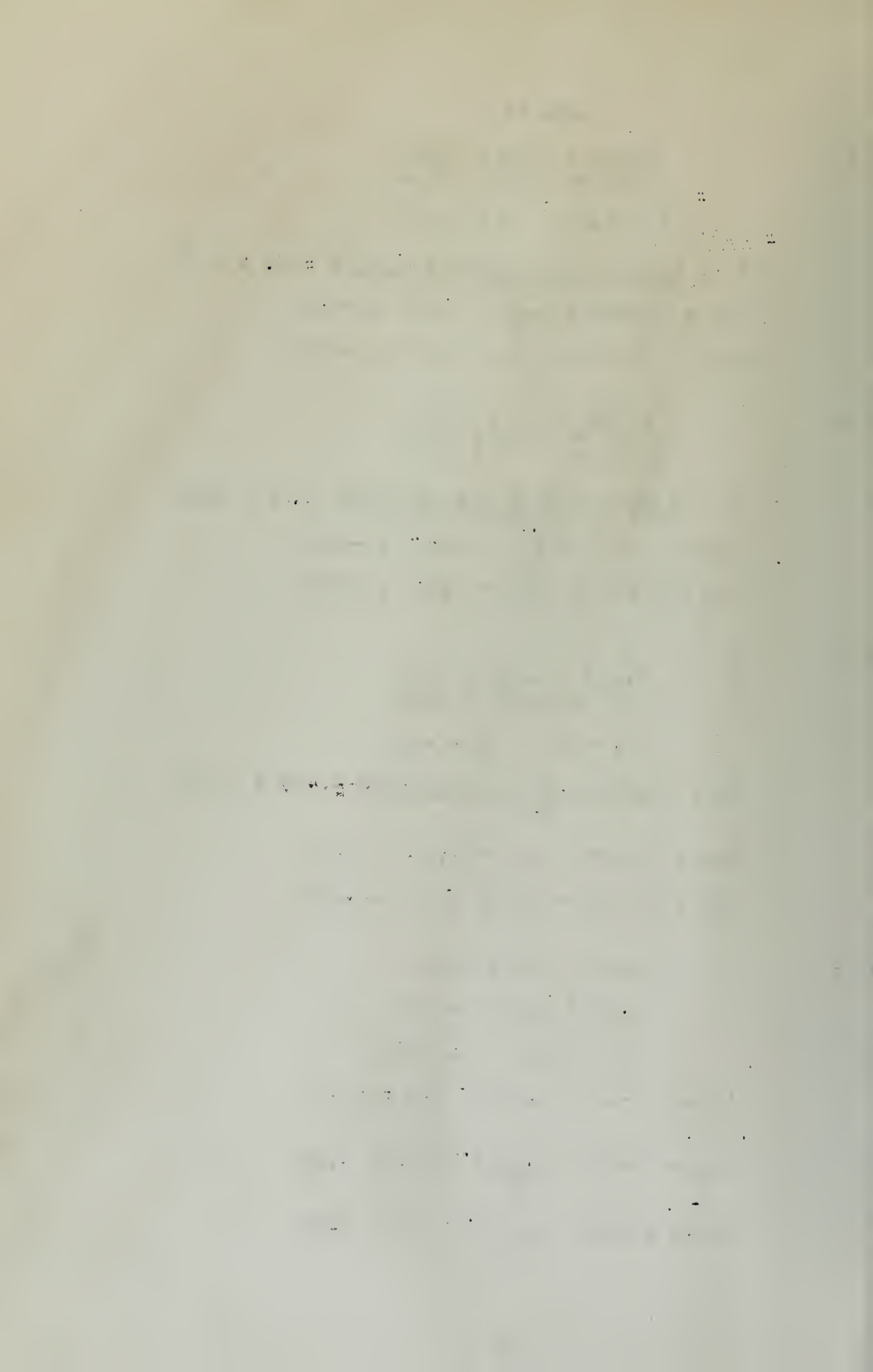
$$-.5D + 6.5E = -1.87$$

$$D = -.41 \quad E = -.32$$

$$R_4 = \frac{3}{4}(-.41 - .32) - .94 = -1.50$$

$$M_{DE} = 2\left(-.41 - \frac{.32}{2} + 1.50\right) = 1.86$$

$$M_{ED} = 2\left(-.32 - \frac{.41}{2} + 1.50\right) = 1.96$$



Panel 5

$$E = -0.32$$

$$F = -0.40$$

$$R_5 = -1.48$$

$$M_{EF} = 1.92$$

$$M_{FE} = 1.84$$

Panel 6

$$F = -0.73$$

$$G = -0.15$$

$$R_6 = -1.18$$

$$M_{FG} = 1.68$$

$$M_{GF} = 1.50$$

Panel 7

$$G = -0.86$$

$$H = -0.85$$

$$R_7 = -1.64$$

$$M_{GH} = 2.05$$

$$M_{HG} = 1.60$$

Panel 8

$$H = -1.16$$

$$I = -1.11$$

$$R_8 = -2.23$$

$$M_{HI} = 1.75$$

$$M_{IH} = 1.84$$

Load at D

$$\begin{aligned} 2.52A - .90B &= 4.38 \\ -1.04A + 2.54B &= 4.49 \end{aligned}$$

$$A = 2.79 \quad B = 2.91$$

$$R_1 = \frac{2.91 \times 2.79 + 2.83 \times 2.91}{3.82} - 1.12 = 5.40$$

$$M_{AB} = 4\left(2.79 + \frac{2.91}{2} - 5.40\right) = -4.64$$

$$M_{BA} = 4\left(2.91 + \frac{2.79}{2} - 5.40\right) = -4.40$$

Panel 2

$$\begin{aligned} 2.52B - .93C &= 4.31 \\ -1.02B + 4.03C &= 4.36 \end{aligned}$$

$$B = 2.33 \quad C = 1.66$$

$$R_2 = \frac{2.96 \times 2.33 + 2.91 \times 1.66}{3.92} - 1.09 = 4.09$$

$$M_{BC} = 4\left(2.33 + \frac{1.66}{2} - 4.09\right) = -3.72$$

$$M_{CB} = 4\left(1.66 + \frac{2.33}{2} - 4.09\right) = -5.08$$

Panel 3

$$\begin{aligned} 3.81C - .65D &= 3.98 \\ -.77C + 5.26D &= 4.12 \end{aligned}$$

$$C = 1.21 \quad D = .96$$

$$R_3 = \frac{2.95 \times 1.21 + 2.90 \times .96}{3.90} - 1.37 = 2.99$$

$$M_{CD} = 3\left(1.21 + \frac{.96}{2} - 2.99\right) = -3.90$$

$$M_{DC} = 3\left(.96 + \frac{1.21}{2} - 2.99\right) = -4.29$$

Panel 4

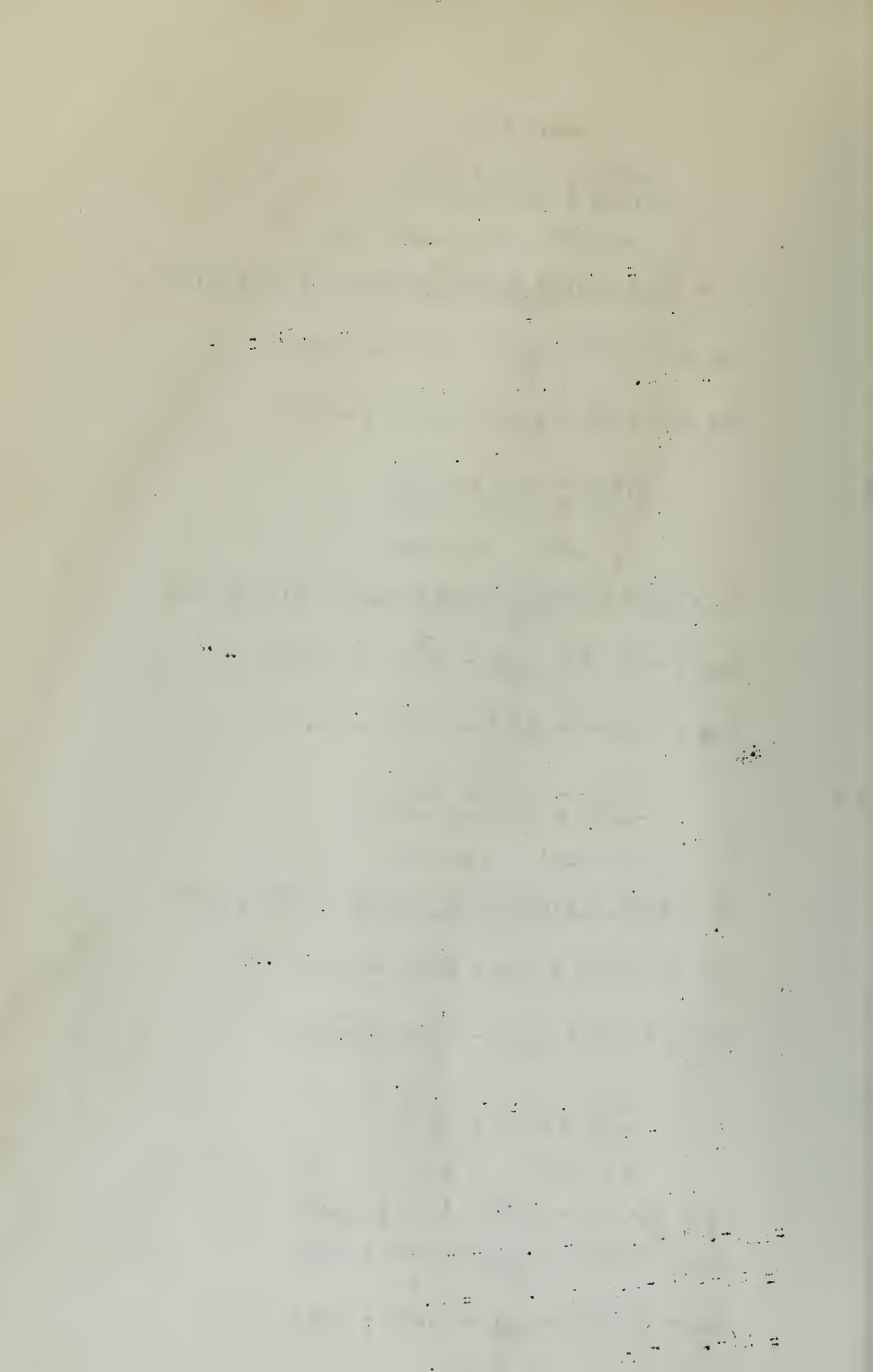
$$\begin{aligned} 5.0D - .5E &= -2.82 \\ -.5D + 6.5E &= -2.82 \end{aligned}$$

$$D = -.61 \quad E = -.48$$

$$R_4 = \frac{3(-.61 - .49)}{4} - 1.41 = -2.23$$

$$M_{DE} = 2\left(-.61 - \frac{.48}{2} + 2.23\right) = 2.76$$

$$M_{ED} = 2\left(-.48 - \frac{.61}{2} + 2.23\right) = 2.90$$



Panel 5

$$E = -0.48$$

$$F = -1.60$$

$$R_5 = -2.22$$

$$M_{EF} = 2.88$$

$$M_{FE} = 2.76$$

Panel 6

$$F = -0.57$$

$$G = -1.72$$

$$R_6 = -1.77$$

$$M_{FG} = 2.52$$

$$M_{GF} = 2.25$$

Panel 7

$$G = -0.99$$

$$H = -1.39$$

$$R_7 = -2.46$$

$$M_{GH} = 3.12$$

$$M_{HG} = 2.40$$

Panel 8

$$H = -1.74$$

$$I = -1.68$$

$$R_8 = -3.24$$

$$M_{HI} = 2.64$$

$$M_{IH} = 2.76$$

1. 1. 1.

2. 2. 2.

3. 3. 3.

4. 4. 4.

5. 5. 5.

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Load at E

Panel 1

$$2.52A - .91B = 3.51$$

$$-1.04A + 2.54B = 3.59$$

$$A = 2.22 \quad B = 2.33$$

$$R_1 = \frac{2.91 \times 2.22 + 2.83 \times 2.33}{3.82} + .90 = 4.32$$

$$M_{AB} = 4\left(2.22 + \frac{2.33}{2} - 4.32\right) = -3.76$$

$$M_{BA} = 4\left(2.33 + \frac{2.22}{2} - 4.32\right) = -3.52$$

Panel 2

$$2.52B - .93C = 3.44$$

$$-1.02B + 4.03C = 3.49$$

$$B = 1.86 \quad C = 1.33$$

$$R_2 = \frac{2.96 \times 1.86 + 2.91 \times 1.33}{3.92} + .87 = 3.26$$

$$M_{BC} = 4\left(1.86 + \frac{1.33}{2} - 3.26\right) = -2.96$$

$$M_{CB} = 4\left(2.33 + \frac{1.86}{2} - 3.26\right) = -4.00$$

Panel 3

$$3.81C - .65D = 3.18$$

$$-.77C + 5.26D = 3.30$$

$$C = .97 \quad D = .77$$

$$R_3 = \frac{2.95 \times .97 + 2.90 \times .77}{3.90} + 1.10 = 2.40$$

$$M_{CD} = 3\left(.97 + .77/2 - 2.40\right) = -3.15$$

$$M_{DC} = 3\left(.77 + .97/2 - 2.40\right) = -3.84$$

Panel 4

$$5.0D - .5E = 3.75$$

$$-.5D + 6.5E = 3.75$$

$$D = .82 \quad E = .64$$

$$R_4 = 3/4\left(.82 + .64\right) + 1.88 = 2.97$$

$$M_{DE} = 2\left(.82 + .64/2 - 2.97\right) = -3.66$$

$$M_{ED} = 2\left(.64 + .82/2 - 2.97\right) = -3.84$$

Panel 5

$$E = -0.64$$

$$F = -0.80$$

$$R_5 = -2.96$$

$$M_{EF} = 3.84$$

$$M_{FE} = 3.68$$

Panel 6

$$F = -0.76$$

$$G = -0.96$$

$$R_6 = -2.36$$

$$M_{FG} = 3.36$$

$$M_{GF} = 3.00$$

Panel 7

$$G = -1.32$$

$$H = -1.84$$

$$R_7 = -3.28$$

$$M_{GH} = 4.16$$

$$M_{HG} = 3.20$$

Panel 8

$$H = -2.32$$

$$I = -2.24$$

$$R_8 = -4.32$$

$$M_{HI} = 3.52$$

$$M_{IH} = 3.68$$

First Moment Corrections - Load at B

Panel 1

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = -1.00$$

$$A = -.16 \quad B = -.46$$

$$R_1 = \frac{-2.91 \times .16 - 2.83 \times .46}{3.83} = -0.46$$

$$M_{AB} = 4(-.16 - .46/2 + .46) = .28$$

$$M_{BA} = 4(-.46 - .16/2 + .46) = -.32$$

Panel 2

$$2.52B - .93C = 5.80$$

$$-1.02B + 4.03C = -1.14$$

$$B = 2.42 \quad C = .33$$

$$R_2 = \frac{2.90 \times 2.42 + 2.91 \times .33}{3.81} = 2.07$$

$$M_{BC} = 4(2.42 + .33/2 - 2.07) = 2.04$$

$$M_{CB} = 4(.33 + 2.42/2 - 2.07) = -2.16$$

Panel 3

$$3.81C - .65D = -1.40$$

$$-.77C + 5.26D = -.92$$

$$C = -.40 \quad D = -.23$$

$$R_3 = \frac{-2.95 \times .40 - 2.90 \times .23}{3.80} = -.47$$

$$M_{CD} = 3(-.40 - .23/2 + .47) = -.12$$

$$M_{DC} = 3(-.23 - .40/2 + .47) = .12$$

Panel 4

$$6.5D - 0.5E = -1.26$$

$$-0.5D + 5.0E = -.96$$

$$D = -.22 \quad E = -.21$$

$$R_4 = 3/4(-.22 - .21) = -.32$$

$$M_{DE} = 2(-.22 - .21/2 + .32) = 0$$

$$M_{ED} = 2(-.21 - .22/2 + .32) = 0$$

Panel 5

$$5.0E - 0.5F = -.96$$

$$-0.5 + 6.5F = -.84$$

$$E = -.21, F = -.14$$

$$R_5 = \frac{3}{2} (-.21 - .14) = -.26$$

$$M_{EF} = 2(-.21 - \frac{.14}{2} + .26) = -.04$$

$$M_{FE} = 2(-.14 - \frac{.21}{2} + .26) = .04$$

Panel 6

$$5.26F + 0.77G = -.92$$

$$-0.65F + 3.81G = -1.04$$

$$F = -.22, G = -.31$$

$$R_6 = \frac{-2.90 \times .22 - 2.95 \times .31}{3.90} = .40$$

$$M_{FG} = 3(-.22 - \frac{.31}{2} + .40) = .06$$

$$M_{GF} = 3(-.31 - \frac{.22}{2} + .40) = -.06$$

Panel 7

$$4.03G - 1.02H = -.75$$

$$-0.93G + 2.52H = -.88$$

$$G = -.30, H = -.46$$

$$R_7 = \frac{-2.91 \times .30 - 2.96 \times .46}{3.91} = -.57$$

$$M_{GH} = 4(-.30 - \frac{.46}{2} + .57) = .16$$

$$M_{HG} = 4(-.46 - \frac{.30}{2} + .57) = -.16$$

Panel 8

$$2.54H - 1.04I = -.60$$

$$-0.94H + 2.52I = 0$$

$$H = -.37, I = -.13$$

$$R_8 = \frac{-2.33 \times .37 - 2.91 \times .13}{3.83} = -.37$$

$$M_{HI} = 4(-.37 - \frac{.13}{2} + .37) = -.24$$

$$M_{IH} = 4(-.13 - \frac{.37}{2} + .37) = .24$$

Second Moment Corrections-Load at B

Panel 1

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = -2.04$$

$$A = -.34, B = -.94$$

$$R_1 = \frac{-2.91 \times .34 - 2.83 \times .94}{3.83} = -.95$$

$$M_{AB} = 4(-.34 - \frac{.94}{2} + .95) = .56$$

$$M_{BA} = 4(-.94 - \frac{.34}{2} + .95) = -.64$$

Panel 3

$$3.81C - .65D = -2.18$$

$$-.77C + 5.26D = 0$$

$$C = -.58, D = -.08$$

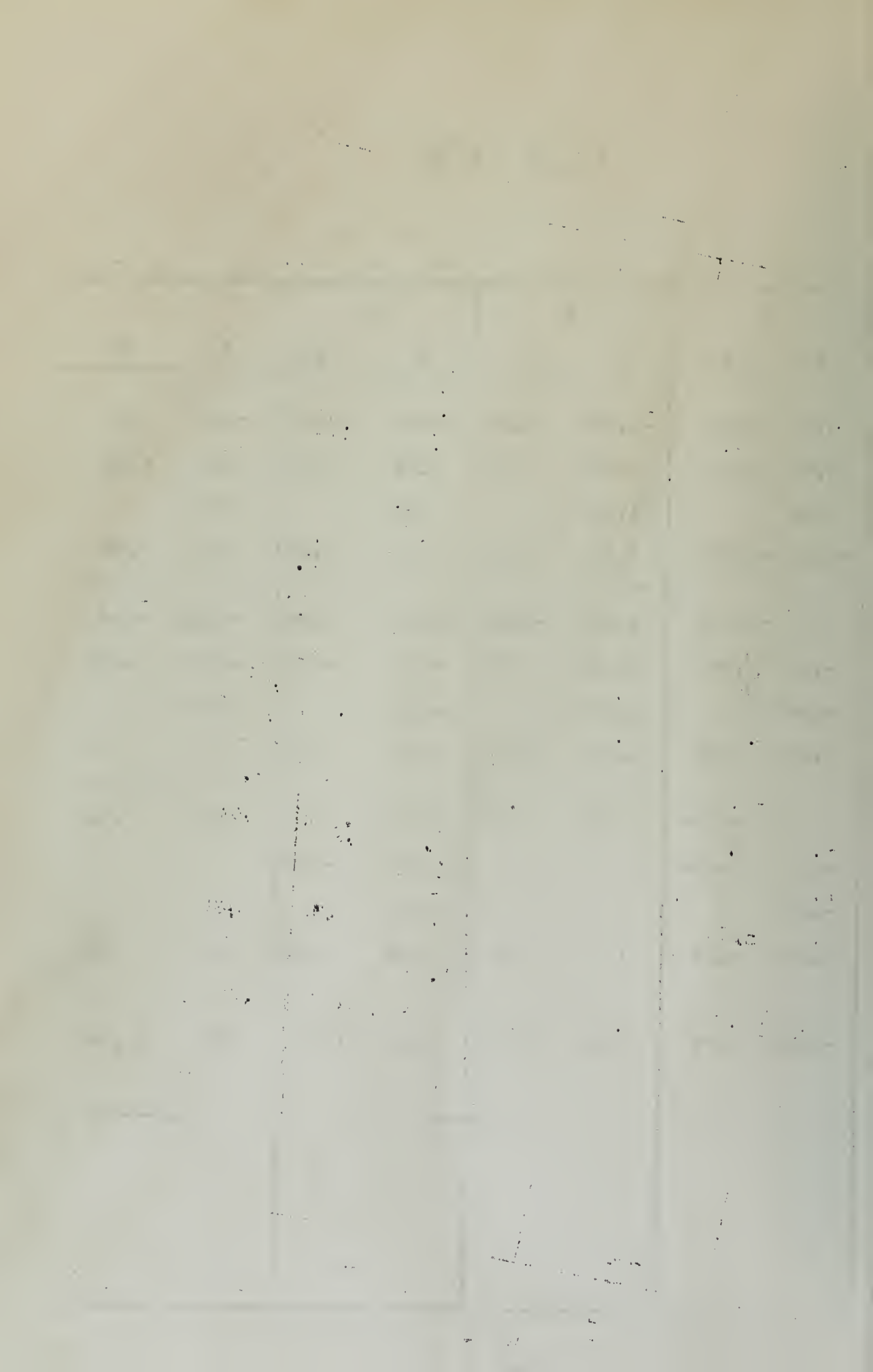
$$R_3 = \frac{-2.95 \times .58 - 2.90 \times .08}{3.90} = -.50$$

$$M_{CD} = 3(-.58 - \frac{.08}{2} + .50) = -.36$$

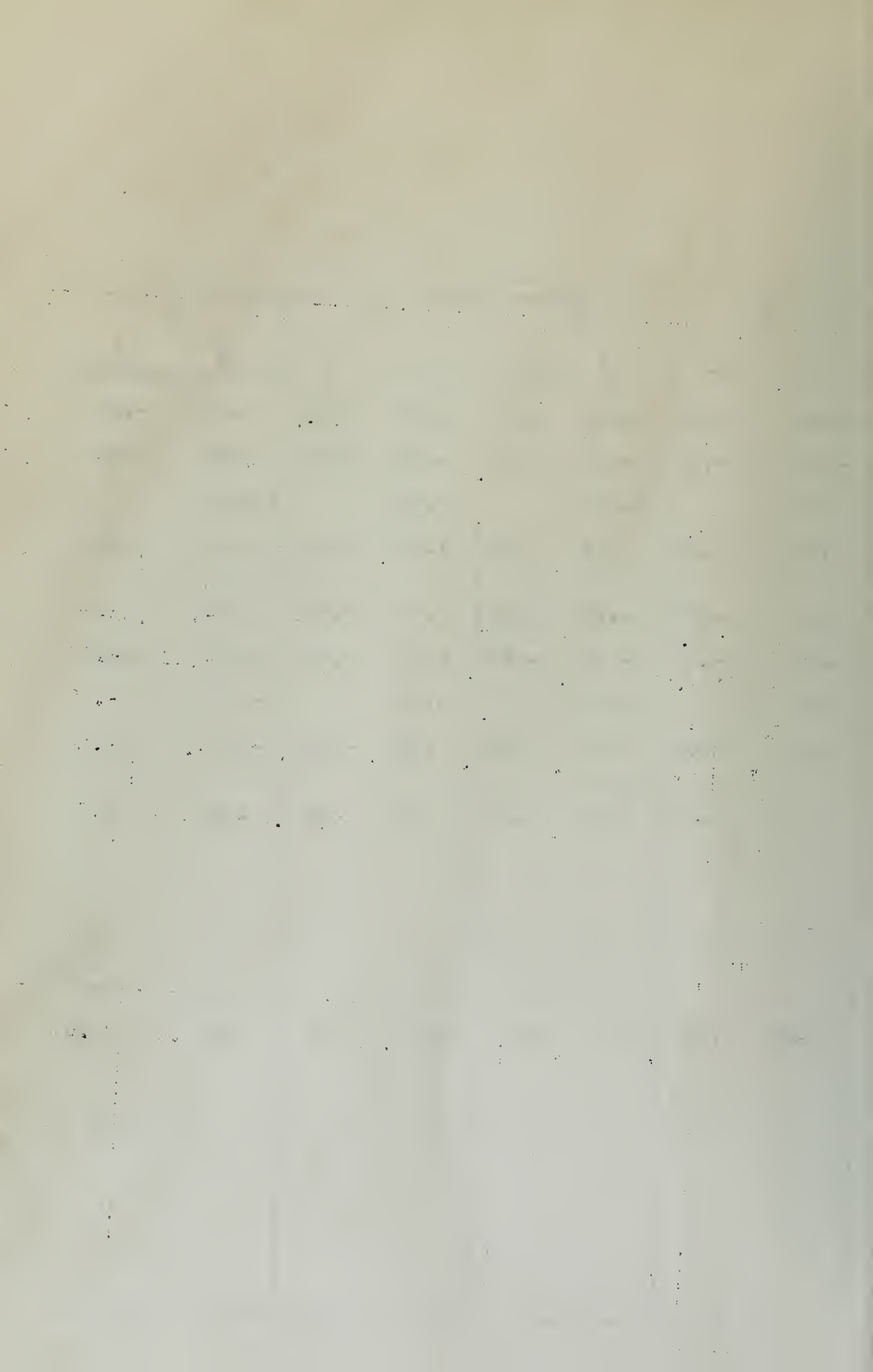
$$M_{DC} = 3(-.08 - \frac{.58}{2} + .50) = .39$$

Load at B

| anel | 1 | | 2 | | 3 | | 4 | |
|-------|-------|-------|-------|-------|-------|-------|-------|------|
| oint | A | B | B | C | C | D | D | E |
| Q | 6.14 | 6.28 | -1.20 | -1.21 | -1.16 | -1.19 | -.94 | -.94 |
| C | 3.89 | 4.07 | -.65 | -.46 | -.35 | -.28 | -.20 | -.16 |
| R | 7.45 | | -1.13 | | -.87 | | -.74 | |
| E' | -6.12 | -5.80 | 1.00 | 1.40 | 1.14 | 1.26 | .92 | .96 |
| Q | 0 | -1.00 | 5.80 | -1.14 | -1.40 | -.92 | -1.26 | -.98 |
| C | -.16 | -.46 | 2.42 | .32 | -.40 | -.23 | -.22 | -.21 |
| R | -.46 | | 2.07 | | -.47 | | -.32 | |
| E'' | .28 | -.32 | 2.04 | -2.16 | -.12 | .12 | 0 | 0 |
| Q | 0 | -2.04 | .32 | .12 | -2.16 | 0 | -.12 | .04 |
| C | -.34 | -.94 | | | -.58 | -.08 | | |
| R | -.95 | | | | -.50 | | | |
| E''' | .56 | -.64 | 0 | 0 | -.36 | .39 | .0 | .00 |
| E'''' | -5.28 | -6.76 | 3.04 | -0.76 | .66 | 1.77 | .92 | .96 |



| Panel
Point | 5 | | 6 | | 7 | | 8 | |
|----------------|------|------|------|-------|------|------|-------|------|
| | E | F | F | G | G | H | H | I |
| Q | -.94 | -.94 | -.82 | -.79 | -.87 | -.86 | -.90 | -.88 |
| X | -.16 | -.20 | -.19 | -.24 | -.33 | -.46 | -.58 | -.56 |
| R | -.74 | | -.59 | | -.82 | | -1.08 | |
| H' | .96 | .92 | .34 | .75 | 1.04 | .80 | .88 | .92 |
| Q | -.96 | -.84 | -.92 | -1.04 | -.75 | -.88 | -.80 | 0 |
| C | -.21 | -.14 | -.22 | -.31 | -.50 | -.46 | -.37 | -.13 |
| R | -.26 | | -.40 | | -.57 | | -.37 | |
| H'' | -.04 | -.04 | .06 | -.06 | .16 | -.16 | -.24 | .24 |
| Q | 0 | -.06 | -.04 | .16 | .06 | .24 | .16 | 0 |
| C | | | | | | | | |
| R | | | | | | | | |
| H''' | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| H | .92 | .96 | .90 | .69 | 1.20 | .64 | .64 | 1.16 |
| | | | | | | | | |
| | | | | | | | | |



First Moment Corrections - Load at C

Panel 1

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = 4.44$$

$$A = .73 \quad B = 2.05$$

$$R_1 = \frac{2.91 \times .73 + 2.83 \times 2.05}{3.83} = 2.06$$

$$M_{AB} = 4(.73 + 2.05/2 - 2.06) = -1.24$$

$$M_{BA} = 4(2.05 + .73/2 - 2.06) = 1.40$$

Panel 2

$$2.52B - .93C = 5.32$$

$$-1.02B + 4.03C = -2.28$$

$$B = 2.10 \quad C = -.04$$

$$R_2 = \frac{2.93 \times 2.10 - 2.91 \times .04}{3.91} = 1.60$$

$$M_{BC} = 4(2.10 - .04/2 - 1.60) = 1.92$$

$$M_{CB} = 4(-.04 + 2.10/2 - 1.60) = -2.04$$

Panel 3

$$3.81C - 0.65D = 6.04$$

$$-0.77C + 5.26D = -1.86$$

$$C = 1.56 \quad D = -.12$$

$$R_3 = \frac{2.95 \times 1.56 - 2.90 \times .12}{3.90} = 1.09$$

$$M_{CD} = 3(1.56 - .12/2 - 1.09) = 1.23$$

$$M_{DC} = 3(-.12 + 1.56/2 - 1.09) = -1.29$$

Panel 4

$$6.5D - 0.5E = -2.49$$

$$-0.5D + 5.0E = -1.92$$

$$D = -.42 \quad E = -.42$$

$$R_4 = 3/4(-.42 - .42) = -.63$$

$$M_{DE} = 2(-.42 - .42/2 + .63) = 0$$

$$M_{ED} = 2(-.42 - .42/2 + .63) = 0$$

Panel 5 $5.0E - 0.5F = -1.96$

$$-0.5E + 6.5F = -1.63$$

$$E = -.42 \quad F = -.29$$

$$R_5 = 3/4(-.42 - .29) = -.53$$

$$M_{EF} = 2(-.42 - .29/2 + .53) = -.06$$

$$M_{FE} = 2(-.29 - .42/2 + .53) = .06$$

Panel 6 $5.26F - 0.77G = -1.84$

$$-0.65F + 3.81G = -2.08$$

$$F = -.44 \quad G = -.62$$

$$R_6 = \frac{-2.90 \times .44 - 2.95 \times .62}{3.96} = -.80$$

$$M_{FG} = 3(-.44 - .62/2 + .80) = .15$$

$$M_{GF} = 3(-.29 - .44/2 + .80) = -.12$$

Panel 7 $4.03G - 1.02H = -1.50$

$$-0.93G + 2.52H = -1.76$$

$$G = -.60 \quad H = -.92$$

$$R_7 = \frac{-2.91 \times .60 - 2.96 \times .92}{3.91} = -1.14$$

$$M_{GH} = 4(-.60 - .92/2 + 1.14) = .32$$

$$M_{HG} = 4(-.92 - .60/2 + 1.14) = -.32$$

Panel 8 $2.54H - 1.04I = -1.60$

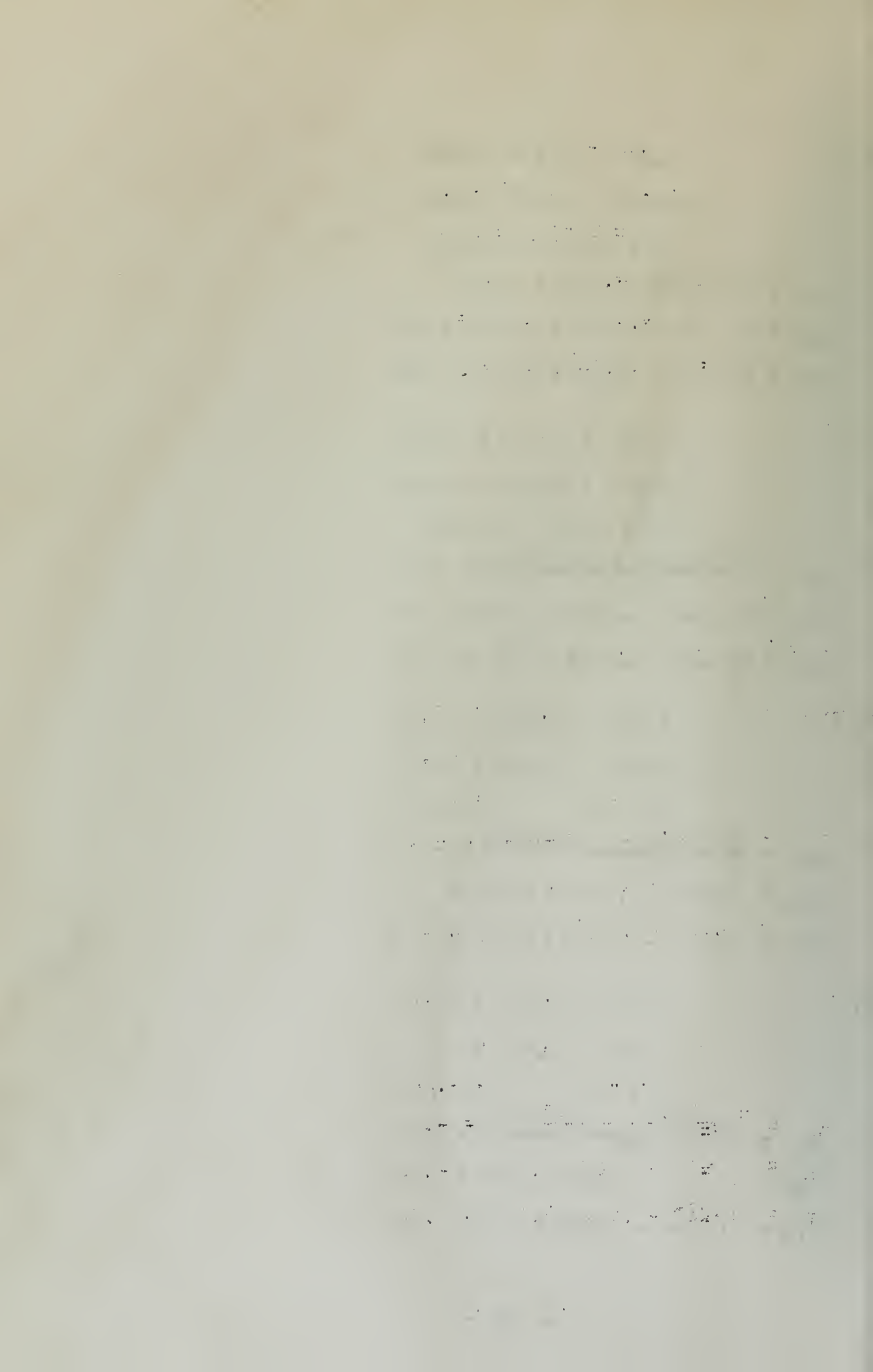
$$-0.90H + 2.52I = 0$$

$$H = -.74 \quad I = -.26$$

$$R_8 = \frac{-2.83 \times .74 - 2.91 \times .26}{3.83} = -.74$$

$$M_{HI} = 4(-.74 - .26/2 + .74) = -.52$$

$$M_{IH} = 4(-.26 - .74/2 + .74) = .44$$



Second Moment Corrections - Load at C

Panel 1

$$2.52A - 0.90B = 0$$

$$-1.04A + 2.54B = -1.92$$

$$A = -.32 \quad B = -.88$$

$$R_1 = \frac{-2.91 \times .32 - 2.83 \times .88}{3.83} = -.89$$

$$M_{AB} = 4(-.32 - .88/2 + .89) = .52$$

$$M_{BA} = 4(-.88 - .32/2 + .89) = -.60$$

Panel 2

$$2.52B - 0.93C = -1.40$$

$$-1.02B + 4.03C = -1.23$$

$$B = -.74 \quad C = -.49$$

$$R_2 = \frac{-2.96 \times .74 - 2.91 \times .49}{3.91} = -.93$$

$$M_{BC} = 4(-.74 - .49/2 + .93) = -.24$$

$$M_{CB} = 4(-.49 - .74/2 + .93) = .28$$

Panel 3

$$3.81C - 0.65D = 2.04$$

$$-0.77C + 5.28D = 0$$

$$C = .55 \quad D = .08$$

$$R_3 = \frac{2.95 \times .55 + 2.90 \times .08}{3.90} = .47$$

$$M_{CD} = 3(.55 + .08/2 - .47) = .36$$

$$M_{DC} = 3(.08 + .55/2 - .47) = -.36$$

Panel 4

$$6.5D - 0.5E = 1.29$$

$$-0.5D + 5.0E = .06$$

$$D = .20 \quad E = .03$$

$$R_4 = 2/4(.20 + .03) = .17$$

$$M_{DE} = 2(.20 + .03/2 - .17) = .08$$

$$M_{ED} = 2(.03 + .20/2 - .17) = -.08$$

nel 5

$$5.0E - 0.5F = 0$$

$$-0.5E + 6.5F = -.15$$

$$E = 0 \quad F = -.02$$

$$R_5 = 3/4(-.02) = -.02$$

$$M_{EF} = 0$$

$$M_{FE} = 0$$

nel 6

$$5.26F - 0.77G = -.06$$

$$-0.65F + 3.81G = -.32$$

$$F = -.02 \quad G = -.08$$

$$R_6 = \frac{-2.90 \times .02 - 2.95 \times .08}{3.90} = -.07$$

$$M_{FG} = 3(-.02 - .08/2 + .07) = .03$$

$$M_{GF} = 3(-.08 - .02/2 + .07) = -.06$$

nel 7

$$4.03G - 1.02H = .12$$

$$-0.93G + 2.52H = .52$$

$$G = .09 \quad H = .24$$

$$R_7 = \frac{2.91 \times .09 + 2.96 \times .24}{3.91} = .25$$

$$M_{GH} = 4(.09 + .24/2 - .25) = -.16$$

$$M_{HG} = 4(.24 + .09/2 - .25) = .16$$

nel 8

$$2.54H - 1.04I = .32$$

$$-0.90H - 2.52I = 0$$

$$H = .15 \quad I = .05$$

$$R_8 = \frac{2.83 \times .15 + 2.91 \times .05}{3.83} = .15$$

$$M_{HI} = 4(.15 + .05/2 - .15) = .10$$

$$M_{IH} = 4(.05 + .15/2 - .15) = -.10$$

Load at C

| Panel | 1 | | 2 | | 3 | | 4 | |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|
| Joint | A | B | B | C | C | D | D | E |
| Q | 5.27 | 5.33 | 5.17 | 5.23 | -2.31 | -2.38 | -1.87 | -1.87 |
| α | 3.33 | 3.48 | 2.79 | 2.00 | - .70 | - .56 | - .41 | - .32 |
| R | 6.47 | | 4.90 | | -1.74 | | -1.50 | |
| M | -5.88 | -5.32 | -4.44 | -6.04 | 2.28 | 2.49 | 1.86 | 1.96 |
| Q | 0 | 4.44 | 5.32 | -2.28 | 6.04 | -1.86 | -2.49 | -1.92 |
| α | .73 | 2.05 | 2.10 | - .04 | 1.56 | - .12 | - .42 | - .42 |
| R | 2.06 | | 1.60 | | 1.09 | | - .63 | |
| M' | -1.24 | 1.40 | 1.92 | -2.04 | 1.23 | -1.29 | 0 | 0 |
| Q | 0 | -1.92 | -1.40 | -1.23 | 2.04 | 0 | 1.29 | .06 |
| | - .32 | - .88 | - .74 | - .49 | .55 | .08 | .20 | .03 |
| R | - .89 | | - .93 | | .47 | | .17 | |
| M'' | .52 | - .60 | - .24 | .28 | .36 | - .36 | .08 | - .08 |
| H | -6.60 | -4.52 | -3.76 | -7.80 | 3.87 | .84 | 1.94 | 1.88 |

1. The first part of the report deals with the general situation of the country and the progress of the work during the year. It is divided into two main sections: the first section deals with the general situation of the country and the progress of the work during the year, and the second section deals with the results of the work during the year.

2. The second part of the report deals with the results of the work during the year. It is divided into two main sections: the first section deals with the results of the work during the year, and the second section deals with the results of the work during the year.

3. The third part of the report deals with the results of the work during the year. It is divided into two main sections: the first section deals with the results of the work during the year, and the second section deals with the results of the work during the year.

4. The fourth part of the report deals with the results of the work during the year. It is divided into two main sections: the first section deals with the results of the work during the year, and the second section deals with the results of the work during the year.

5. The fifth part of the report deals with the results of the work during the year. It is divided into two main sections: the first section deals with the results of the work during the year, and the second section deals with the results of the work during the year.

6. The sixth part of the report deals with the results of the work during the year. It is divided into two main sections: the first section deals with the results of the work during the year, and the second section deals with the results of the work during the year.

7. The seventh part of the report deals with the results of the work during the year. It is divided into two main sections: the first section deals with the results of the work during the year, and the second section deals with the results of the work during the year.

8. The eighth part of the report deals with the results of the work during the year. It is divided into two main sections: the first section deals with the results of the work during the year, and the second section deals with the results of the work during the year.

9. The ninth part of the report deals with the results of the work during the year. It is divided into two main sections: the first section deals with the results of the work during the year, and the second section deals with the results of the work during the year.

10. The tenth part of the report deals with the results of the work during the year. It is divided into two main sections: the first section deals with the results of the work during the year, and the second section deals with the results of the work during the year.

| 5 | | 6 | | 7 | | 8 | |
|------|-------|-------|-------|-------|-------|-------|-------|
| E | F | F | G | G | H | H | I |
| 1.88 | -1.88 | -1.64 | -1.58 | -1.74 | -1.72 | -1.80 | -1.76 |
| .32 | - .40 | - .38 | - .48 | - .66 | - .93 | -1.16 | -1.12 |
| 1.48 | | -1.16 | | -1.64 | | -2.16 | |
| 1.92 | 1.84 | 1.68 | 1.50 | 2.08 | 1.60 | 1.76 | 1.84 |
| 1.96 | -1.68 | -1.84 | -2.08 | -1.50 | -1.76 | -1.60 | 0 |
| .42 | - .29 | - .44 | - .62 | - .60 | - .92 | - .74 | - .26 |
| .53 | | - .80 | | -1.14 | | - .74 | |
| .06 | .06 | .15 | - .12 | .32 | - .32 | - .52 | .44 |
| 0 | - .15 | - .06 | - .32 | .12 | .52 | .32 | 0 |
| 0 | - .02 | - .02 | - .08 | .09 | .24 | .15 | .05 |
| .02 | | - .07 | | .25 | | .15 | |
| 0 | 0 | .03 | - .06 | - .16 | .16 | .10 | - .10 |
| 1.86 | 1.90 | 1.86 | 1.32 | 2.24 | 1.44 | 1.34 | 2.28 |

1. The first part of the paper discusses the importance of the study of the history of the United States. It is a subject of great interest and importance to all Americans. The study of our history helps us to understand our present and to plan for our future.

2. The second part of the paper discusses the importance of the study of the history of the United States. It is a subject of great interest and importance to all Americans. The study of our history helps us to understand our present and to plan for our future.

3. The third part of the paper discusses the importance of the study of the history of the United States. It is a subject of great interest and importance to all Americans. The study of our history helps us to understand our present and to plan for our future.

4. The fourth part of the paper discusses the importance of the study of the history of the United States. It is a subject of great interest and importance to all Americans. The study of our history helps us to understand our present and to plan for our future.

5. The fifth part of the paper discusses the importance of the study of the history of the United States. It is a subject of great interest and importance to all Americans. The study of our history helps us to understand our present and to plan for our future.

Panel 5

$$-.5F + 6.5E = -2.90$$

$$5.0F - .5E = -2.52$$

$$E = -.49, F = -.55, R_5 = -1.70$$

$$I_{FE} = 2(-.49 - .55/2 + 1.70) = .04$$

$$I_{EF} = 2(-.55 - .49/2 + 1.70) = -1.02$$

Panel 6

$$-.77G + 5.26F = -2.76$$

$$3.01G - .65F = -3.12$$

$$F = -.66, G = -.93, R_6 = -1.20$$

$$I_{FG} = 3(-.66 - .93/2 + 1.20) = .21$$

$$I_{GF} = 3(-.93 - .66/2 + 1.20) = -1.18$$

Panel 7

$$-1.02H + 4.03G = -2.25$$

$$2.52H - .93G = -2.64$$

$$G = -.91, H = -1.30, R_7 = -1.71$$

$$I_{GH} = 4(-.91 - 1.30/2 + 1.71) = .44$$

$$I_{HG} = 4(-1.30 - .91/2 + 1.71) = -.48$$

Panel 8

$$-1.04I + 2.54H = -2.40$$

$$2.52I - .90H = 0$$

$$H = -1.11, I = -.39, R_8 = -1.12$$

$$I_{HI} = 4(-1.11 - .39/2 + 1.12) = -.72$$

$$I_{IH} = 4(-.39 - 1.11/2 + 1.12) = .72$$

Influence Line Corrections - Second Set - Load at D

Panel 1

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = -.80$$

$$A = -.13, B = -.37, R_1 = -.37$$

$$M_{AB} = 4(-.13 - .37/2 + .37) = .24$$

$$M_{BA} = 4(-.37 - .13/2 + .37) = -.24$$

Panel 2

$$2.52B - .93C = -1.08$$

$$-1.02B + 4.03C = -1.17$$

$$B = -.59, C = -.44, R_2 = -.77$$

$$M_{BC} = 4(-.59 - .44/2 + .77) = -.16$$

$$M_{CB} = 4(-.44 - .59/2 + .77) = .16$$

Panel 3

$$3.81C - .65D = .76$$

$$-.77C + 5.26D = +1.60$$

$$C = .18, D = -.09, R_3 = .08$$

$$M_{CD} = 3(.18 - .09/2 - .08) = .18$$

$$M_{DC} = 3(-.09 + .18/2 - .08) = -.24$$

Panel 4

$$5.0D - .5E = 1.26$$

$$-.5D + 6.5E = -.54$$

$$D = .25, E = .01, R_4 = .20$$

$$M_{DE} = 2(.25 + .01/2 - .20) = .10$$

$$M_{ED} = 2(.01 + .25/2 - .20) = -.14$$

Panel 5

$$-.5F + 6.5E = .60$$

$$5.0F - .5E = -.21$$

$$E = .09, F = -.03, R_5 = .04$$

$$M_{EF} = 2(.09 - .03/2 - .04) = .08$$

$$M_{FE} = 2(-.03 + .09/2 - .04) = -.06$$

Panel 6

$$-.77G + 5.26F = .02$$

$$3.81G - .65F = -.44$$

$$F = -.01, G = -.12, R_6 = -.10$$

$$M_{FG} = 3(-.01 - .12/2 + .10) = .09$$

$$M_{GF} = 3(-.12 - .01/2 + .10) = -.09$$

Panel 7

$$-1.02H + 4.03G = .18$$

$$2.52H - .93G = .72$$

$$G = .13, H = .33, R_7 = .35$$

$$M_{GH} = 4(.13 + .33/2 - .35) = -.24$$

$$M_{HG} = 4(.33 + .13/2 - .35) = .20$$

Panel 8

$$-1.04I + 2.54H = .48$$

$$2.52I - .90H = 0$$

$$H = .22, I = .08, R_8 = .22$$

$$M_{HI} = 4(.22 + .08/2 - .22) = .16$$

$$M_{IH} = 4(.08 + .22/2 - .22) = -.12$$

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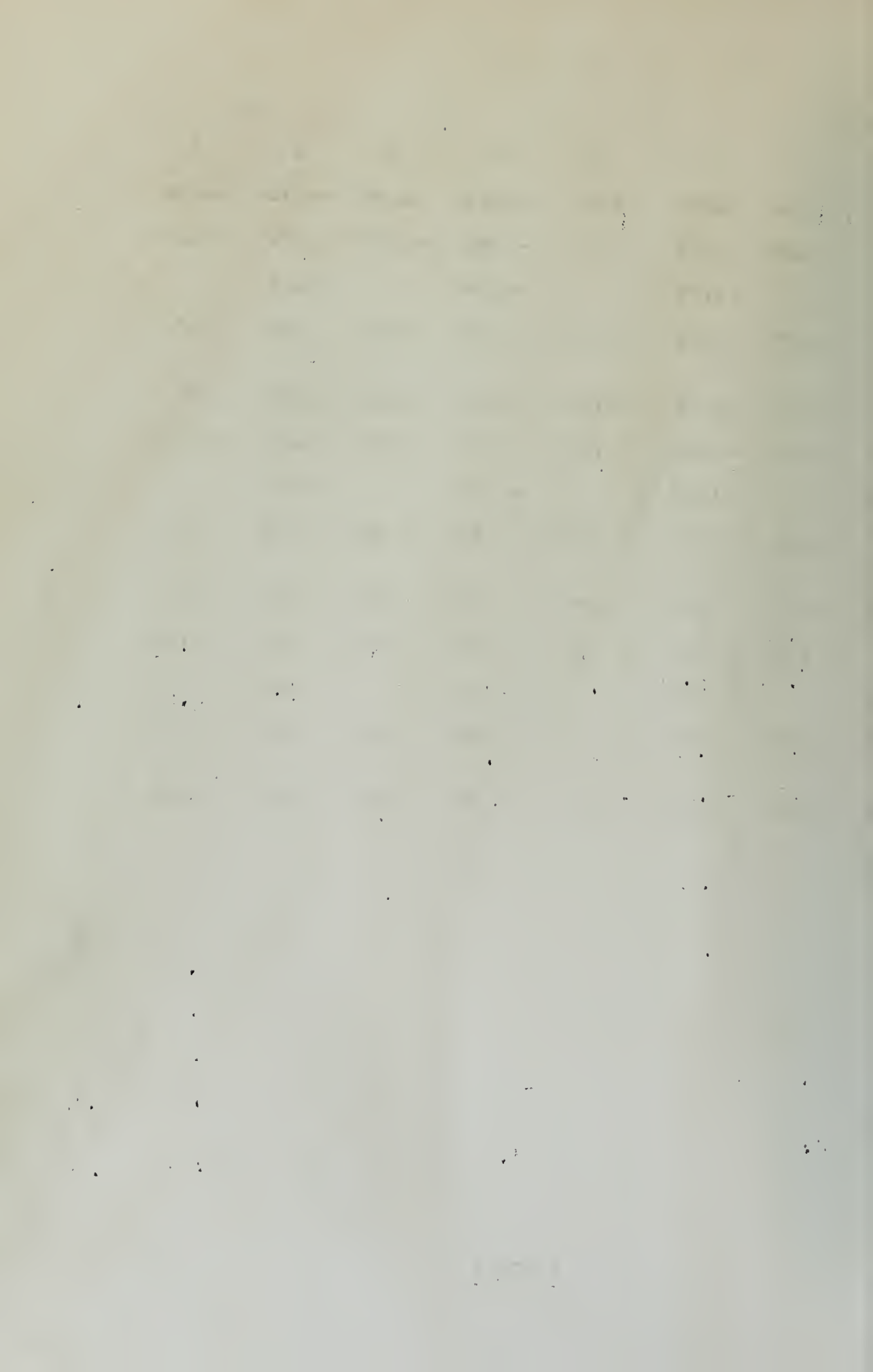
Load at D

| anel | 1 | | 2 | | 3 | | 4 | |
|------|-------|-------|-------|-------|-------|-------|-------|-------|
| oint | A | B | B | C | C | D | D | E |
| Q | 4.38 | 4.49 | 4.31 | 4.36 | 3.98 | 4.12 | -2.82 | -2.82 |
| α | 2.79 | 2.91 | 2.33 | 1.66 | 1.21 | .96 | - .61 | - .48 |
| R | 5.40 | | 4.09 | | 2.99 | | -2.23 | |
| W | -4.64 | -4.40 | -3.72 | -5.08 | -3.90 | -4.29 | 2.76 | 2.90 |
| Q | 0 | 3.72 | 4.40 | 3.90 | 5.08 | -2.76 | 4.29 | -2.88 |
| | .61 | 1.72 | 2.32 | 1.55 | 1.28 | - .34 | .82 | - .38 |
| R | 1.74 | | 2.90 | | .72 | | .33 | |
| W | -1.08 | 1.08 | .80 | - .76 | 1.17 | -1.26 | .60 | - .60 |
| Q | 0 | - .80 | -1.08 | -1.17 | .76 | - .60 | 1.26 | - .04 |
| | - .13 | - .37 | - .59 | - .44 | .18 | - .09 | .25 | .01 |
| R | - .37 | | - .77 | | .08 | | .20 | |
| W | .24 | - .24 | - .16 | .16 | .18 | - .24 | .10 | - .14 |
| M | -5.48 | -3.56 | -3.08 | -5.68 | -2.53 | -5.79 | 3.46 | 2.16 |

Load at D

| nel | 1 | | 2 | | 3 | 4 | | |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|
| int | A | B | B | C | C | D | D | E |
| Q | 4.38 | 4.49 | 4.31 | 4.36 | 3.98 | 4.12 | -2.82 | -2.82 |
| X | 2.79 | 2.91 | 2.33 | 1.66 | 1.21 | .96 | - .61 | - .48 |
| R | 5.40 | | 4.09 | | 2.99 | | -2.23 | |
| M | -4.64 | -4.40 | -3.72 | -5.08 | -3.90 | -4.29 | 2.76 | 2.90 |
| Q | 0 | 3.72 | 4.40 | 3.90 | 5.08 | -2.76 | 4.29 | -2.88 |
| | .61 | 1.72 | 2.32 | 1.55 | 1.28 | - .34 | .82 | - .38 |
| R | 1.74 | | 2.90 | | .72 | | .33 | |
| M | -1.08 | 1.08 | .80 | - .76 | 1.17 | -1.26 | .60 | - .60 |
| Q | 0 | - .80 | -1.08 | -1.17 | .76 | - .60 | 1.26 | - .04 |
| | - .13 | - .37 | - .59 | - .44 | .18 | - .09 | .25 | .01 |
| R | - .37 | | - .77 | | .08 | | .20 | |
| M | .24 | - .24 | - .16 | .16 | .18 | - .24 | .10 | - .14 |
| M | -5.48 | -3.56 | -3.08 | -5.68 | -2.53 | -5.79 | 3.46 | 2.16 |

| | 5 | | 6 | | 7 | | 8 | |
|------|-------|-------|-------|-------|-------|-------|-------|--|
| E | F | F | G | G | H | H | I | |
| 2.82 | -2.82 | -2.46 | -2.37 | -2.61 | -2.58 | -2.70 | -2.64 | |
| .48 | - .60 | - .57 | - .72 | - .99 | -1.39 | -1.74 | -1.68 | |
| 2.22 | | -1.77 | | -2.46 | | -3.24 | | |
| 2.88 | 2.76 | 2.52 | 2.25 | 3.12 | 2.40 | 2.64 | 2.76 | |
| 2.90 | -2.52 | -2.76 | -3.12 | -2.25 | -2.64 | -2.40 | 0 | |
| .49 | - .55 | - .66 | - .93 | - .91 | -1.38 | -1.11 | - .39 | |
| .78 | | -1.20 | | -1.71 | | -1.12 | | |
| .04 | - .02 | .21 | - .18 | .44 | - .48 | - .72 | .72 | |
| .60 | - .21 | .02 | - .44 | .18 | .72 | .48 | 0 | |
| .09 | - .03 | - .01 | - .12 | .13 | .33 | .22 | .08 | |
| .04 | | - .10 | | .35 | | .22 | | |
| .08 | - .06 | .09 | - .09 | - .24 | .20 | .16 | - .12 | |
| 3.00 | 2.68 | 2.82 | 1.98 | 3.32 | 2.12 | 2.08 | 3.36 | |



Influence Line Corrections - First Set - Load at E

anel 1,8

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = 2.96$$

$$A = .49, B = 1.37, R_1 = 1.39$$

$$M_{AB} = 4(.49 + 1.37/2 - 1.39) = -.88$$

$$M_{BA} = 4(1.37 + .49/2 - 1.39) = .88$$

anel 2,7

$$2.52B - .93C = 3.52$$

$$-1.02B + 4.03C = 3.15$$

$$B = 1.86, C = 1.25, R_2 = 2.33$$

$$M_{BC} = 4(1.86 + 1.25/2 - 2.33) = .60$$

$$M_{CB} = 4(1.25 + 1.86/2 - 2.33) = -.60$$

anel 3,6

$$3.81C - .65D = 4.00$$

$$-.77C + 5.26D = 3.66$$

$$C = 1.20, D = .87, R_3 = 1.55$$

$$M_{CD} = 3(1.20 + .87/2 - 1.55) = .24$$

$$M_{DC} = 3(.87 + 1.20/2 - 1.55) = -.24$$

anel 4,5

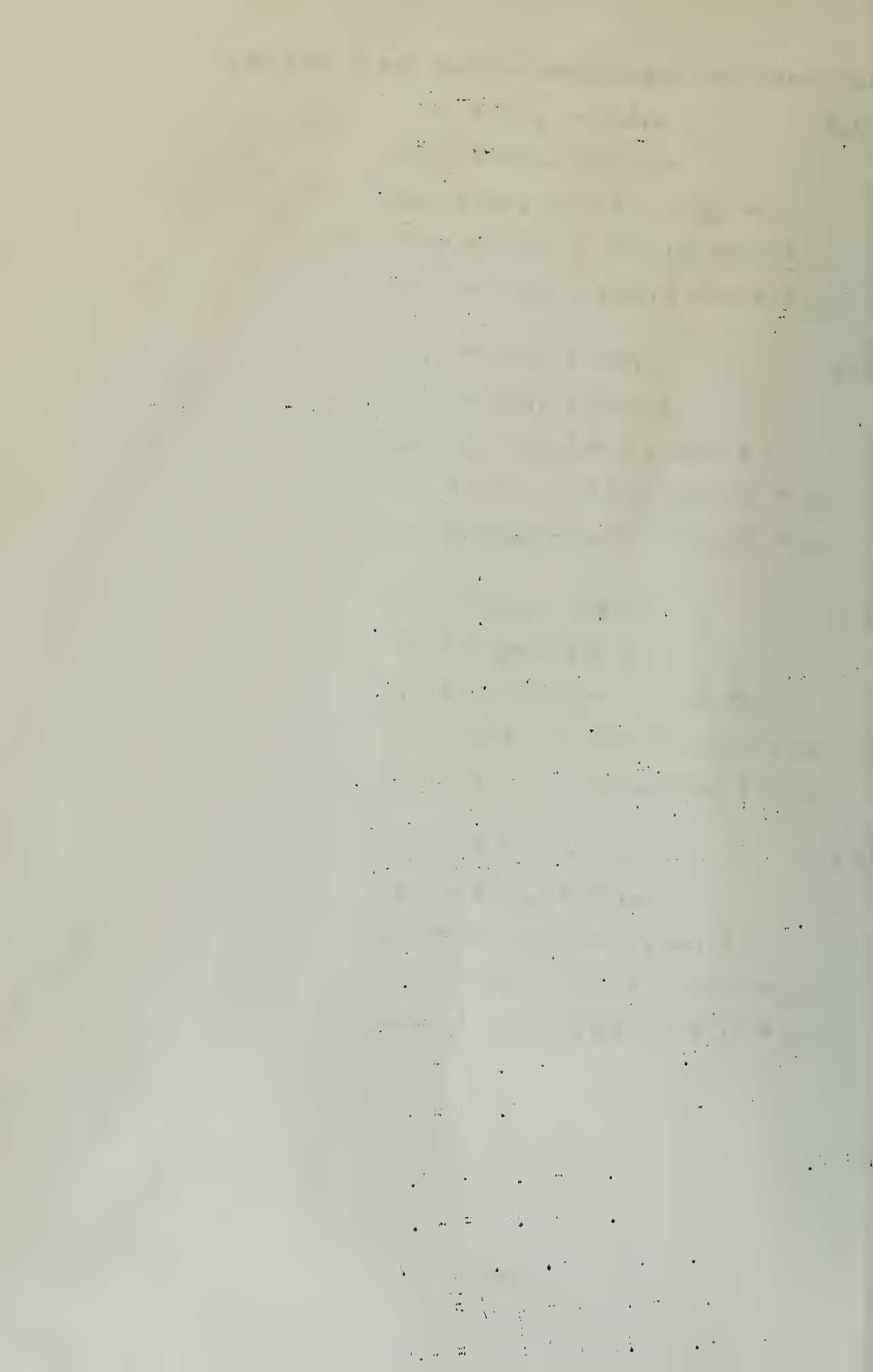
$$5.0D - .5E = 3.45$$

$$-1.5D + 6.5E = -.84$$

$$D = .64, E = -.54, R_4 = .08$$

$$M_{DE} = 2(.64 - .54/2 - .08) = .58$$

$$M_{ED} = 2(-.54 + .64/2 - .08) = -.60$$



Influence Line Corrections - Second Set - Load at E

Panel 1,8

$$2.52A - .90B = 0$$

$$-1.04A + 2.54B = -.20$$

$$A = -.10, B = -.28, R_1 = -.28$$

$$M_{AB} = 4(-.10 - .28/2 + .28) = .16$$

$$M_{BA} = 4(-.28 - .10/2 + .28) = -.20$$

Panel 2,7

$$2.52B - .93C = -.88$$

$$-1.02B + 4.3C = -.24$$

$$B = -.41, C = -.16, R_2 = -.43$$

$$M_{BC} = 4(-.41 - .16/2 + .43) = -.24$$

$$M_{CB} = 4(-.16 - .41/2 + .43) = .24$$

Panel 3,6

$$3.81C - .65D = .60$$

$$-.77C + 5.26D = -.58$$

$$C = .14, D = -.09, R_3 = .04$$

$$M_{CD} = 3(.14 - .09/2 - .04) = .18$$

$$M_{DC} = 3(-.09 + .14/2 - .04) = -.18$$

Panel 4,5

$$5.1D - .51E = .24$$

$$-.5D + 6.5E = -.60$$

$$D = .04, E = -.09, R_4 = -.04$$

$$M_{DE} = 2(.04 - .09/2 + .04) = .06$$

$$M_{ED} = 2(-.09 + .04/2 + .04) = -.06$$

3

1

10

• • •

1. The first group of people who are interested in the study of the history of the United States are the people who are interested in the history of the United States.

100

[illegible]

18

100

100

1. The first group of authors (e.g., Berman, 1984; Berman & ...)

1910-11-10. - 1910-11-11.

1. *Chlorophyll a* (Chl *a*)

Journal of Management Education 30(6)

100

1990

1. The first group of people who are interested in the study of the history of the United States are the people who are interested in the history of the United States.

10

Load at E

| Panel | 1 | | 2 | | 3 | | 4 | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Point | A | B | B | C | C | D | D | E |
| Q | 3.51 | 3.59 | 3.44 | 3.49 | 3.18 | 3.30 | 3.25 | 3.75 |
| X | 2.22 | 2.33 | 1.86 | 1.33 | .97 | .77 | .82 | .64 |
| R | 4.32 | | 3.26 | | 2.40 | | 2.97 | |
| L | -3.76 | -3.52 | -2.96 | -4.00 | -3.15 | -3.45 | -3.66 | -3.84 |
| Q | 0 | 2.96 | 3.52 | 3.15 | 4.00 | 3.66 | 3.45 | -3.84 |
| X | .49 | 1.37 | 1.86 | 1.25 | 1.20 | .87 | .64 | -.54 |
| R | 1.39 | | 2.33 | | 1.55 | | .08 | |
| L | .88 | .88 | .60 | -.60 | .24 | -.24 | .58 | -.60 |
| Q | 0 | -.60 | -.88 | -.24 | .60 | -.58 | .24 | -.60 |
| X | .10 | -.28 | -.41 | -.16 | .14 | -.09 | .04 | -.09 |
| R | -.28 | | -.3 | | .04 | | .04 | |
| L | .16 | -.20 | -.24 | .24 | .18 | .18 | .06 | -.06 |
| L | -4.48 | -2.84 | -2.60 | -4.36 | -2.73 | -3.87 | -3.02 | -4.50 |

| | 5 | | 6 | | 7 | | 8 |
|------|-------|-------|-------|-------|-------|-------|--------|
| E | F | F | G | G | H | H | I |
| 3.75 | -3.75 | -3.30 | -3.18 | -3.49 | -3.44 | -3.59 | -3.51 |
| .64 | - .82 | - .77 | - .97 | -1.33 | -1.86 | -2.73 | -2.22 |
| 2.97 | | -2.40 | | -3.26 | | -4.32 | |
| 3.84 | 3.66 | 3.45 | 3.15 | 4.00 | 2.96 | 3.52 | 3.76 |
| 3.84 | -3.45 | -3.66 | -4.00 | -3.15 | -3.52 | -2.96 | 0 |
| .54 | - .64 | - .87 | -1.20 | -1.25 | -1.86 | -1.37 | - .149 |
| .08 | | -1.55 | | -2.33 | | -1.39 | |
| .60 | - .58 | .24 | - .24 | .60 | - .60 | - .88 | .88 |
| .60 | - .24 | .58 | - .60 | .24 | .88 | .60 | 0 |
| .09 | - .04 | .09 | - .14 | .16 | .41 | .28 | .10 |
| .04 | | - .04 | | .43 | | .28 | |
| .06 | - .06 | .18 | - .18 | .24 | .24 | .20 | - .16 |
| 4.50 | 3.02 | 3.87 | 2.73 | 4.36 | 2.60 | 2.84 | 4.48 |

Moment Computations - Web Members

Member AA' DL = 3510 fk
 LL-E60 = 3008
 Impact = 644
 Total = 7162

LL H15-S12-44 = 412
 Conc. = 97
 Impact = 70
 Total = 579

Sidewalk = 246

Design Moment = 7,937 fk

Member BB' DL = 3980 fk
 LL-E60 = 3395
 Impact = 725
 Total = 8100

LL H15-S12-44 = 465
 Conc. = 109
 Impact = 78
 Total = 652

Sidewalk = 278

Design Moment = 9,030 fk

Member CC' DL = 3690 fk
 LL-E60 = 3200
 Impact = 736
 Total = 7626

LL H15-S12-44 = 432
 Conc. = 101
 Impact = 80
 Total = 613

Sidewalk = 258

Design Moment = 8,497 fk

ber DD'

DL = 2422 f.k.

LL-E60 = 2193

Impact = 590

Total 5205

LL H15-S12 - 44 = 284

Conc. = 97

Impact = 66

Total = 447

Sidewalk = 192

Design Moment = 5,844 f.k.

ber EE'

DL = 1323 f.k.

LL-E60 = 1272

Impact = 445

Total = 3040

LL H15-S12-44 = 155

Conc. = 73

Impact = 47

Total = 275

Sidewalk = 120

Design Moment = 3,435 f.k.

Moment Computations - Chord Members

Member AB

DL = 3510 f.k.
LL-E60 = 3008
Impact = 644

Total = 7162

LL H15-S12-44 = 412
Conc. = 97
Impact = 70

Total = 579
Sidewalk = 246

Design Moment = 7,987 f.k.

Member BC

DL = 3120 f.k.
LL-E60 = 2800
Impact = 642

Total = 6562

LL H15-S12-44 = 365
Conc. = 105
Impact = 71

Total = 541
Sidewalk = 226

Design Moment = 7,329 f.k.

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er CD

| | | |
|---------------|---|------|
| DL | = | 1828 |
| W-E60 | = | 1692 |
| Impact | = | 434 |
| <hr/> | | |
| Total | = | 3954 |
| LL H15-S12-44 | = | 214 |
| Conc. | = | 78 |
| Impact | = | 49 |
| <hr/> | | |
| Total | = | 341 |
| Sidewalk | = | 141 |

Design Moment = 4,436 f.k.

er DE

| | | |
|---------------|---|------|
| DL | = | 1172 |
| W-E60 | = | 1138 |
| Impact | = | 342 |
| <hr/> | | |
| Total | = | 2652 |
| LL H15-S12-44 | = | 137 |
| Conc. | = | 61 |
| Impact | = | 37 |
| <hr/> | | |
| Total | = | 235 |
| Sidewalk | = | 99 |

Design Moment = 2,986 f.k.

1891
 1892
 1893

1894
 1895
 1896

1897
 1898
 1899

1900
 1901
 1902

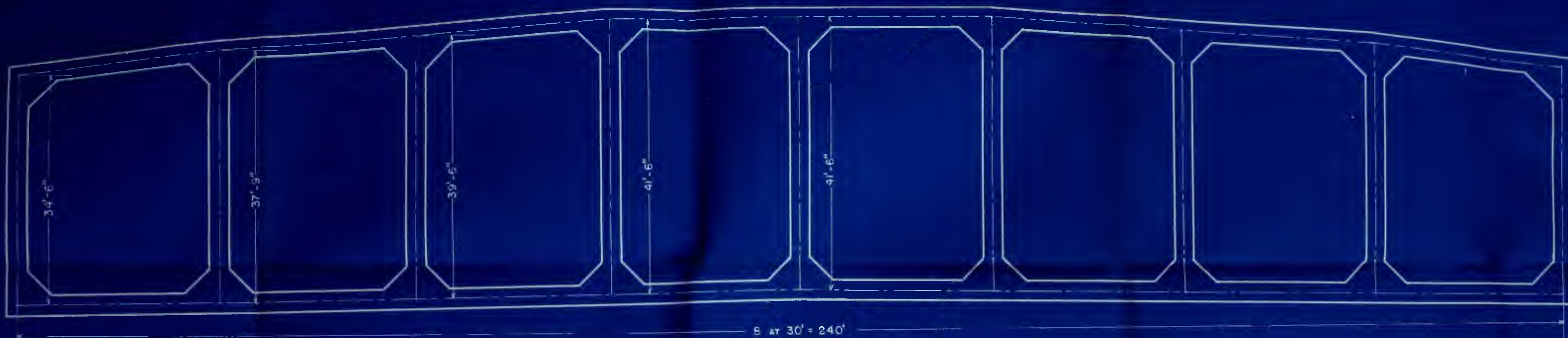
1903
 1904
 1905

1906
 1907
 1908

1909
 1910
 1911

1912
 1913
 1914

1915
 1916
 1917

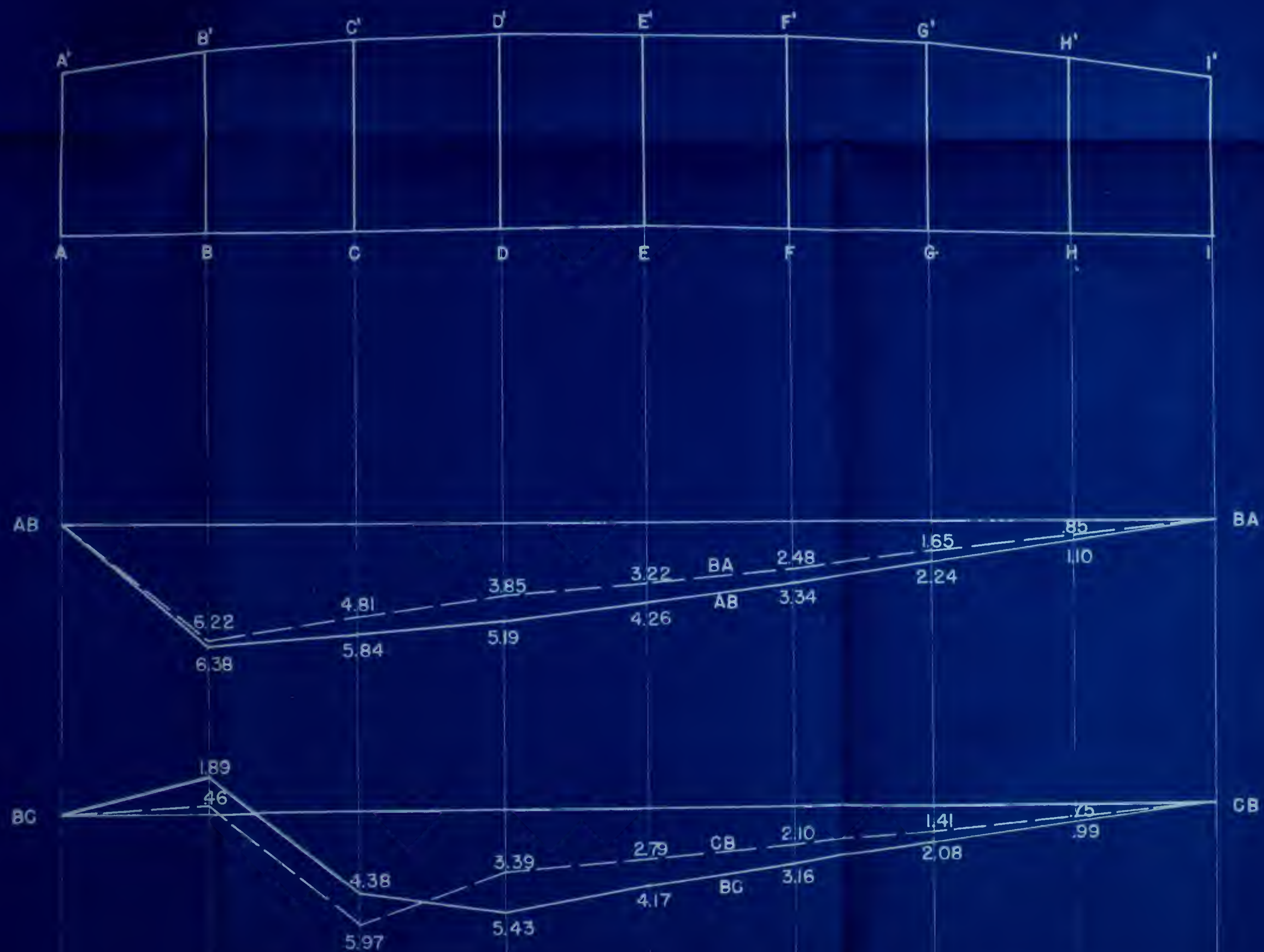


| | | | | | | | |
|--|--|--|---------------------------------------|---------------------------------------|--|--|--|
| $m = \frac{37.75 - 34.50}{37.75} = 0.0866$ | $m = \frac{39.50 - 37.75}{39.50} = 0.0443$ | $m = \frac{41.50 - 39.50}{41.50} = 0.0482$ | $m = \frac{41.50 - 41.50}{41.50} = 0$ | $m = \frac{41.50 - 41.50}{41.50} = 0$ | $m = \frac{41.50 - 39.50}{41.50} = 0.0482$ | $m = \frac{39.50 - 37.75}{39.50} = 0.0443$ | $m = \frac{37.75 - 34.50}{37.75} = 0.0866$ |
| $n = \frac{37.75 - 34.50}{34.50} = 0.0942$ | $n = \frac{39.50 - 37.75}{37.75} = 0.0463$ | $n = \frac{41.50 - 39.50}{39.50} = 0.0507$ | $n = \frac{41.50 - 41.50}{41.50} = 0$ | $n = \frac{41.50 - 41.50}{41.50} = 0$ | $n = \frac{41.50 - 39.50}{39.50} = 0.0507$ | $n = \frac{39.50 - 37.75}{37.75} = 0.0463$ | $n = \frac{37.75 - 34.50}{34.50} = 0.0942$ |

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SCALE 1" = 10'
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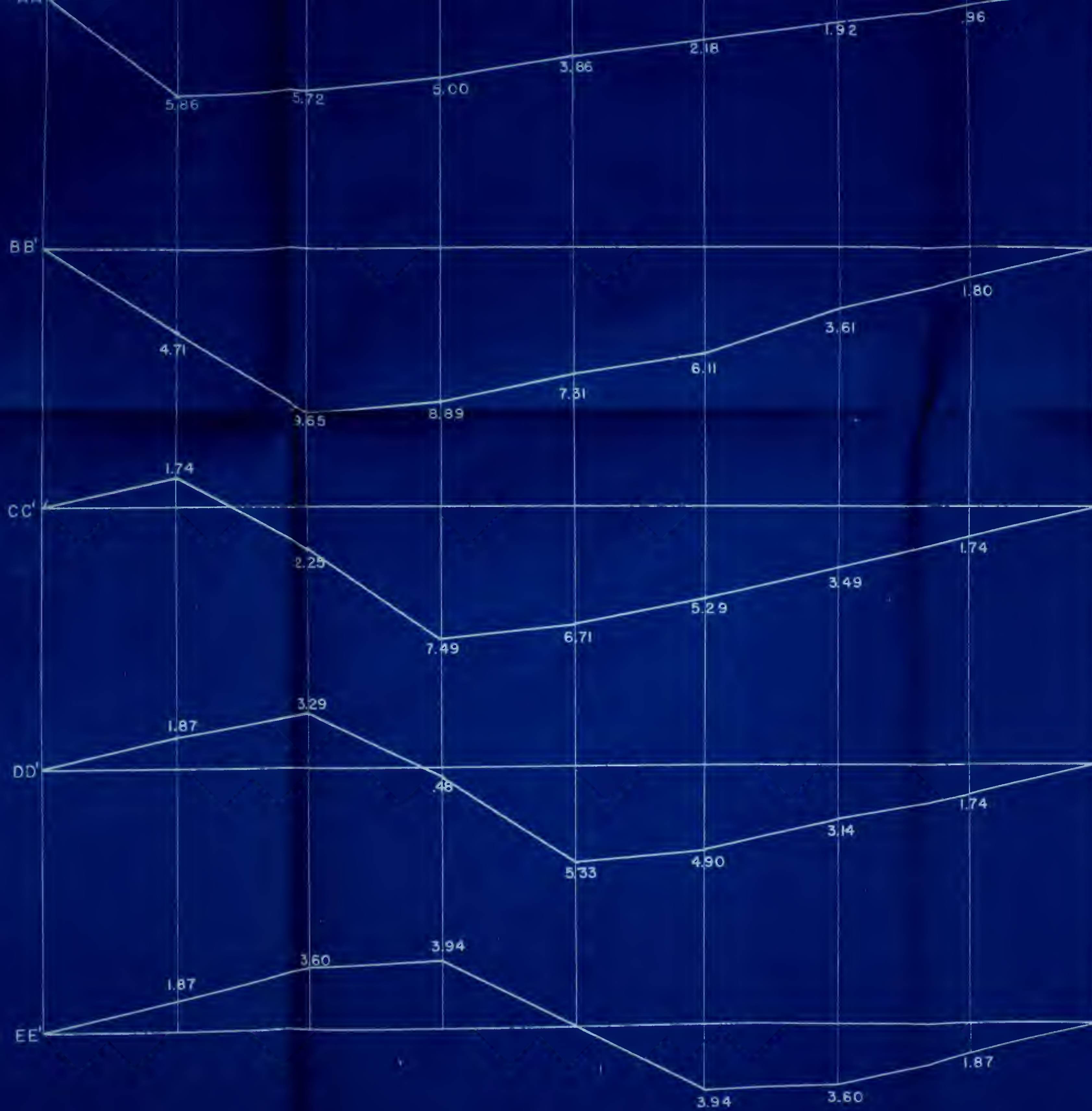
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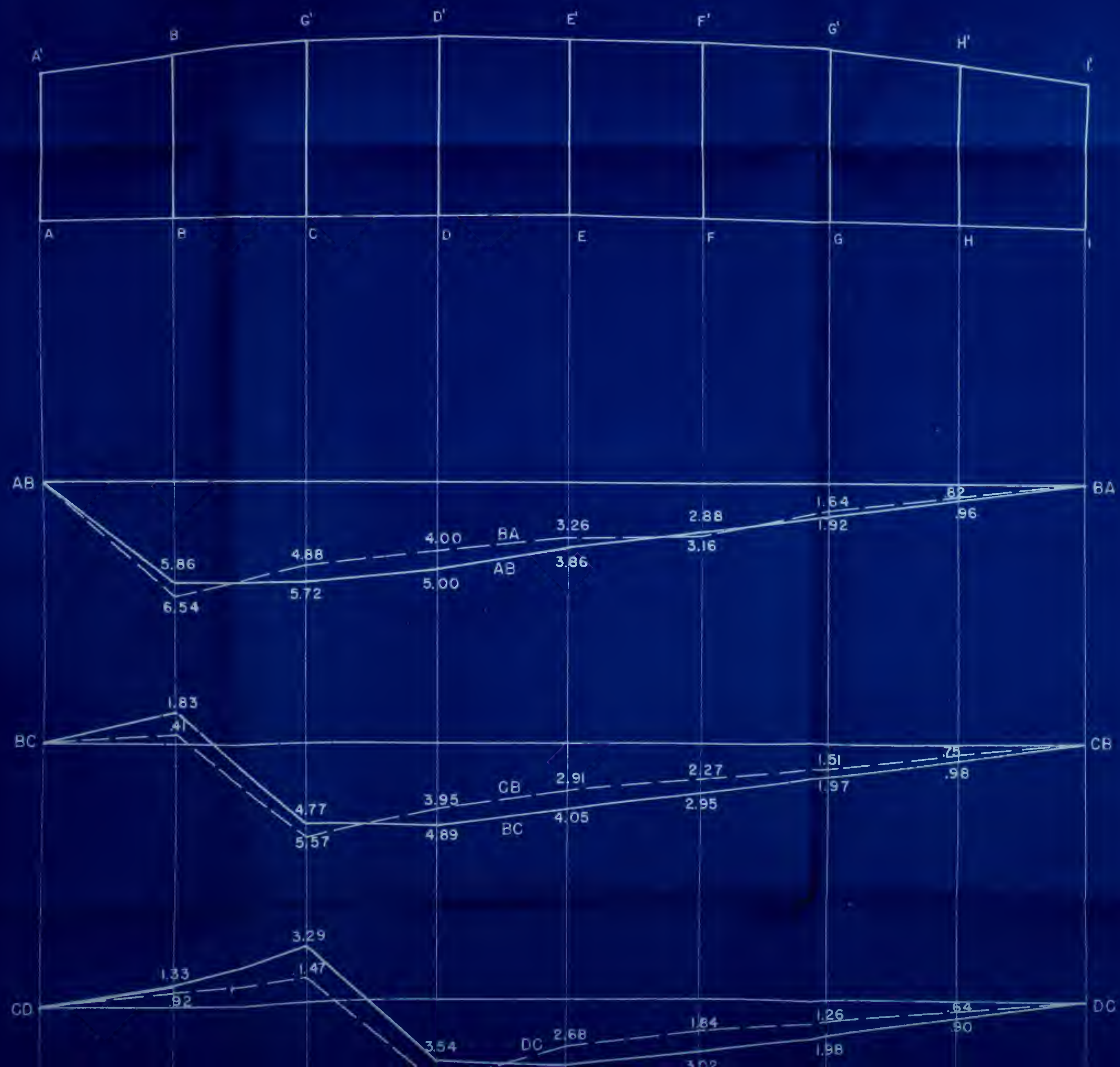
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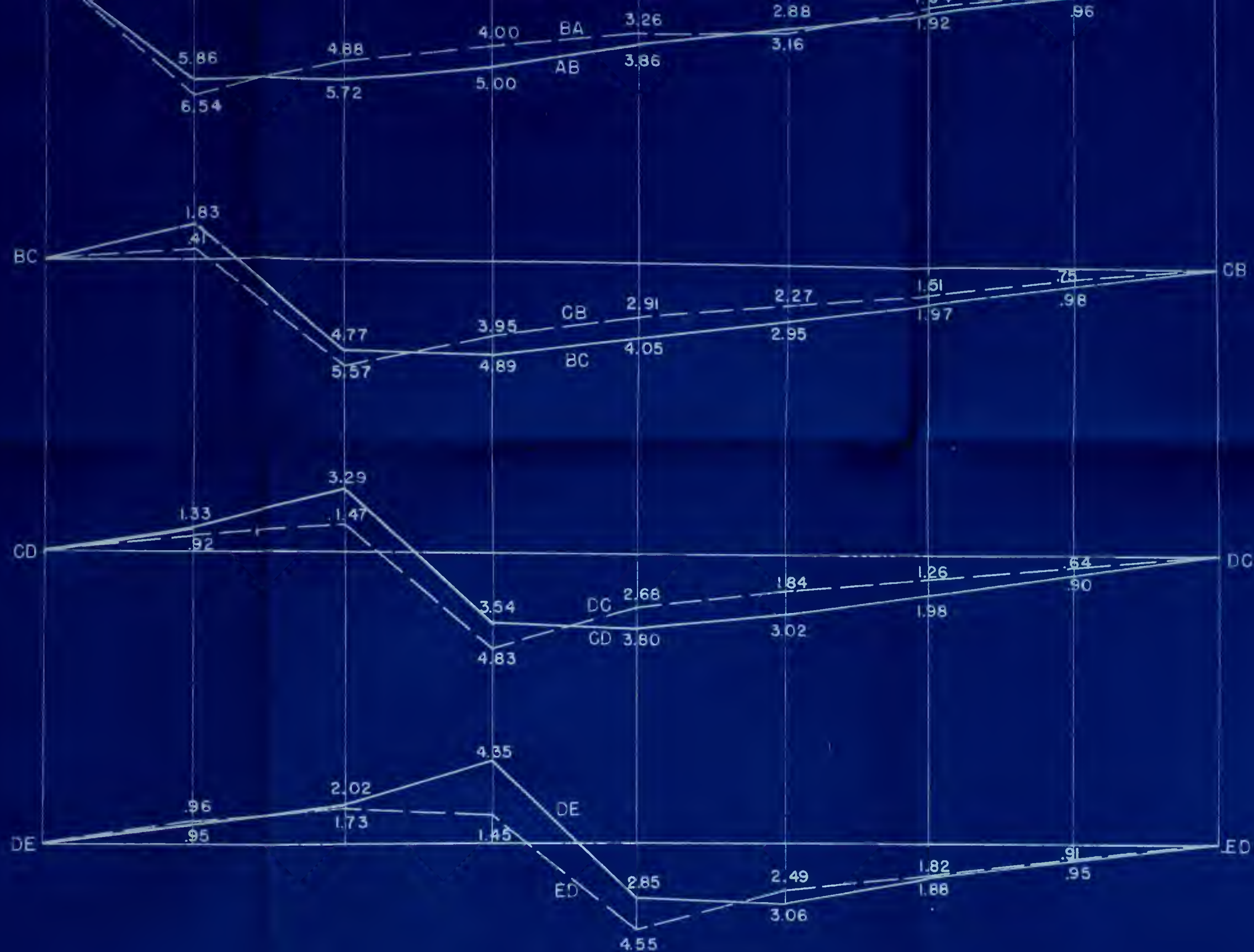
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1" = 5 F.K.

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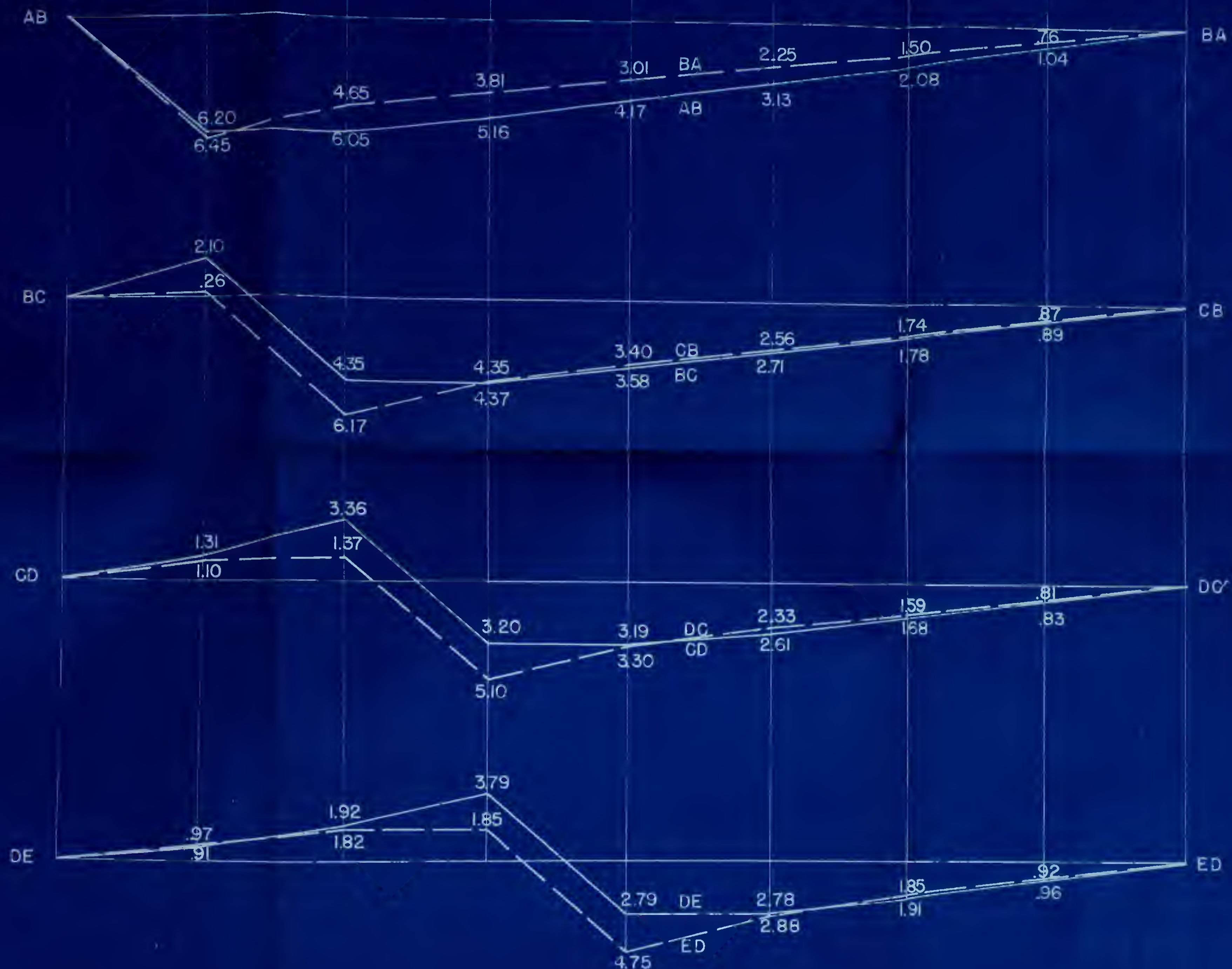
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Thesis

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M3 Manning

Investigation of the
effect of stiffness of
members upon the solution
of Vierendeel trusses.

Thesis

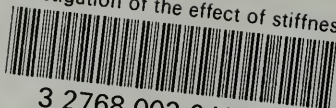
6889

M3 Manning

Investigation of the
effect of stiffness of
members upon the solution
of Vierendeel trusses.

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Investigation of the effect of stiffness



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